

# Machinery



MACHINING BERYLLIUM TO  
EXTREMELY CLOSE TOLERANCES ON  
HARDINGE HIGH SPEED PRECISION MACHINES  
AT THE

*United States Beryllium Corp.*  
INGLEWOOD, CALIFORNIA



# NEW

## Standard "Building-Block" Units for AUTOMATION UNLIMITED

As these scale models show, Heald's new line of standard "building-block" units can be combined in virtually any desired arrangement for single or multiple station automated production equipment. Slide units and Borizers can approach the work vertically, horizontally or at an angle, to perform any desired drilling, boring, reaming, tapping, probing, facing or grooving operations within their range and capacity.

The flexibility of these standard units provides max-

imum versatility in meeting your specific automation requirements—simplifies even major job changeovers by facilitating retooling, removal, relocation or addition of work stations—and safeguards your investment by substantially reducing losses from obsolescence.

Your Heald engineer will be glad to show you how this "building-block" approach can solve your automation problems from rough to finish.

*It PAYS to come to Heald*

**THE HEALD MACHINE COMPANY**

Subsidiary of The Cincinnati Milling Machine Co.  
Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • Milwaukee • New York • Philadelphia • Syracuse



DECEMBER 1960

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# Machinery

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**IN WAYNESBORO, PENNSYLVANIA,**

**A SKILLED LABOR FORCE IS AT WORK**

**PRODUCING QUALITY THREAD GENER-**

**ATING EQUIPMENT FOR CUTTING,**

**ROLLING, TAPPING AND GRINDING**

**OPERATIONS.**



*May these people put their skills to work for you?*

**LANDIS Machine COMPANY**

**WAYNESBORO, PENNSYLVANIA**

**THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT**

580C

For more data circle this page number on card at back of book

# how's this for high-speed hobbing?

WORK PIECE					HOB (1 start)				Pieces per Load	Method*	Time per Piece	Pieces per Grind	Cut
Dia. Pitch	No. of Teeth	Helix Angle	Face Width	Material	Dia.	RPM	Feed						
10	20	15°	1 3/4"	1040 leaded	3"	500	.395	.055"	1	A	2 min. 25 sec.	150	Finish
7	23	13°	3/4"	8620	4"	350	.370	.100"	2	A and B	59 sec.	240	Pre-shave
5	43	24°	1 5/8"	8620	4"	280	.300	.100"	2	B	3 min. 45 sec.	80	Pre-shave

\* Method A: Diagonal Hobbing. Method B: Step-by-step Hobbing.

## This is the kind of performance you get with THE FELLOWS-PFAUTER P400 HIGH-SPEED HOBBING MACHINE

**HIGH-SPEED HOBBING.** Performance speaks louder than words. The examples given above show the results of high-speed hobbing which can cut costs. The figures are taken from the records of typical production runs on the Fellows-Pfauter P400.

**DESIGN.** The P400 was designed for High-Speed Hobbing, and it features a new basic design. The individual machine elements are of maximum rigidity. The hob head is heavy and rugged, the machine column and bed are of double-wall construction with heavy V-ways and the work table is as large as the maximum permissible work piece diameter. The index worm gear is nearly as large as the work table, and the work support column is of massive construction. All parts of the machine are properly proportioned and of sturdy design to eliminate vibration. The cost is more than justified by the resulting reductions in hobbing times and the increased hob life.

**RIGIDITY and CLOSE TOLERANCES.** The large size work table and index worm gear and the oversize hob head, which eliminates lead errors caused by hob breakout, are important

factors in providing the rigidity necessary to hold work to close tolerances.

**COMPLETELY OPEN WORKING AREA.** The machine and the work-support columns are of such rigid construction that the hobbing stresses are absorbed without requiring an over-arm. Therefore the working area is easily accessible for set-up and work loading. The automatic retraction of the table from the hob also facilitates changing of work.

**SET-UP TIMES and FLOOR-TO-FLOOR TIMES** are reduced on the P400 because it has infinitely variable speeds and feeds, rapid traverses for all machine movements, including hob shifting manually by push button, and built-in hydraulics for the operation of the tailstock and simple hydraulic fixtures used on this machine.

**AUTOMATION** on the P400 is simple and fast. The illustrations show a machine equipped with automatic loading and unloading devices.

**GEAR HOBBING COSTS** can be cut by high-speed hobbing on a P400 because of the resulting savings in production time, floor space, maintenance and labor.



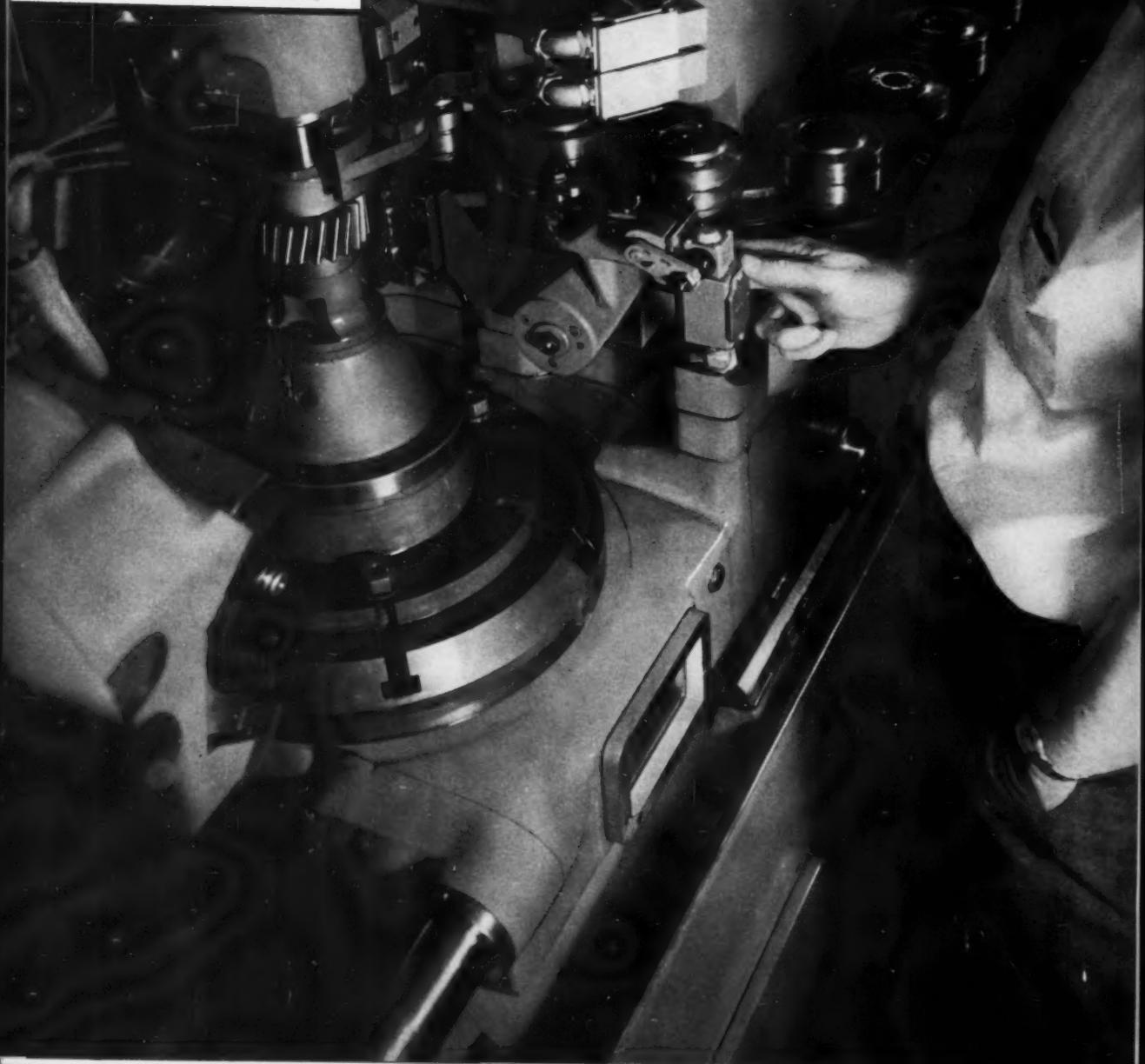
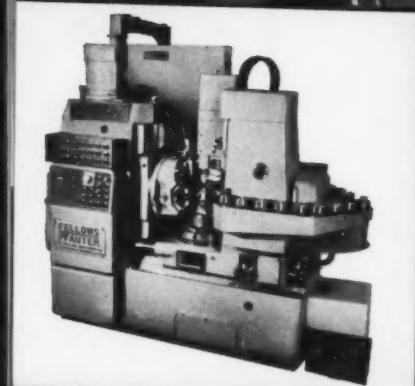
THE PRECISION LINE

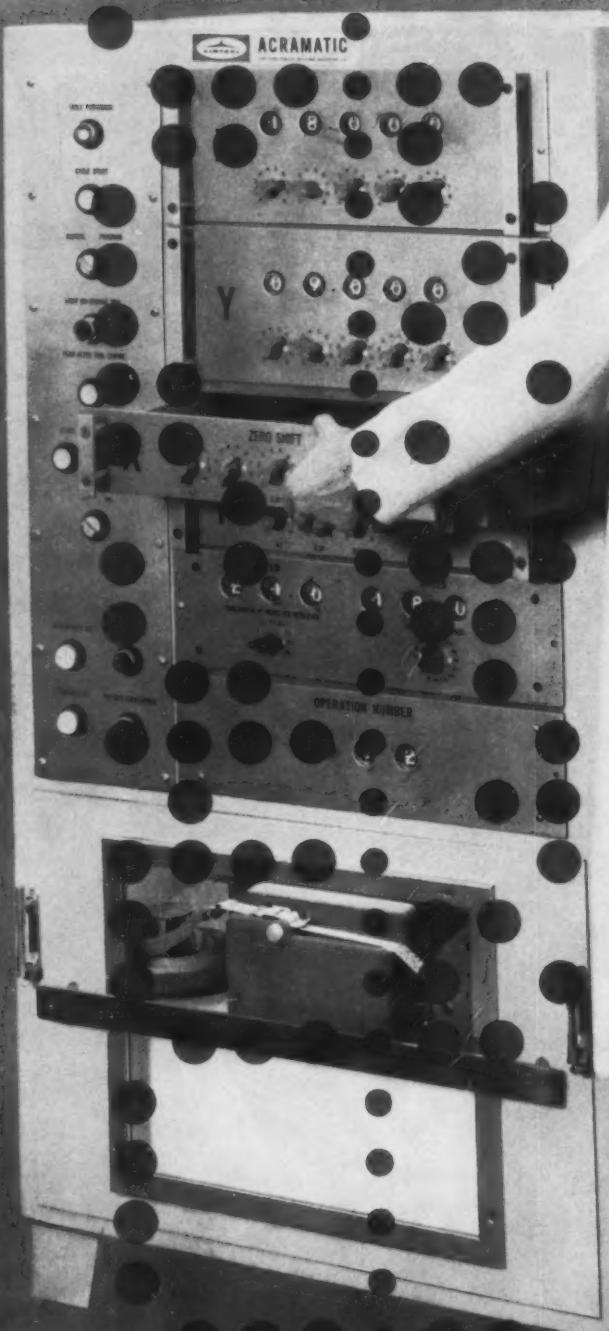
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THE FELLOWS GEAR SHAPER COMPANY 78 River Street, Springfield, Vermont, U.S.A.

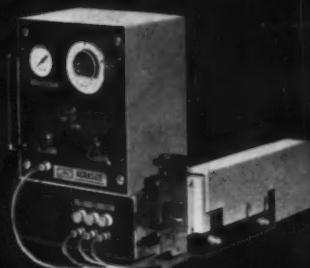
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*Gear Production Equipment*





ACRAMATIC Two-Axis Simultaneous Positioning System,  
demonstrating the convenience of modular construction



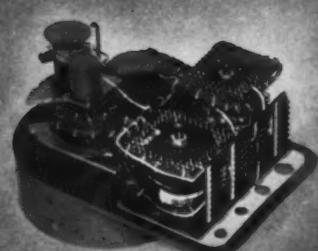
ACRASIZE "Jump-on" Gage System



GRIND-A-MATE Gage System



ACRATRACE three dimensional tracer mechanism



ACRAMATIC Contouring System feedback unit



# CINCINNATI MILLING ANNOUNCES CIMTROL DIVISION

More than 30 years ago The Cincinnati Milling Machine Co. pioneered in the use of hydraulics for milling machine control. This basic method of control led to the development of many unique types of hydraulic, electronic and electro-hydraulic controls and systems—for milling, grinding, die sinking, broaching and special machines built by Cincinnati.

So important is this technology today that Cincinnati has established the CIMTROL Division (compounded from the words "Cincinnati Milling" and "control"). The only full line manufacturer of machine control systems, this new Division is responsible for engineering, manufacturing, marketing and servicing of controls for applications in products of original equipment builders.

The CIMTROL Division's exhibit at the Machine Tool Exposition presented three groups of products: ACRAMATIC Numerical Control; ACRATRACE tracing systems; ACRASIZE gaging systems. The Division also offers programming services for ACRAMATIC Numerical Control. Original equipment builders are invited to present their machine control problems to Cincinnati. CIMTROL Division engineers have the background to work out the best solution. **Cimtrol Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



**CINCINNATI**

ACRAMATIC NUMERICAL CONTROL SYSTEMS • ACRATRACE  
TRACING SYSTEMS • ACRASIZE GAGING SYSTEMS

**Now... a completely automatic**



# crankshaft grinder with indexing 'on the fly'

This new crankpin grinder can automatically grind, to close tolerances, more crankshafts per hour than you have ever produced before.

In addition to indexing on the fly, other automatic features that give this machine its higher production are Truform dressing, lateral locating, workrest advance, Micro-feed® and sizing.

## LANDIS

world leader in precision grinders

LANDIS TOOL COMPANY, WAYNESBORO, PA.



### **For your cylindrical grinding**

... Norton brings you cylindrical grinders which provide a new higher wheel speed of 8500 SFFPM. In test after test Norton Machines using "high-speed" Norton wheels have proved their ability to operate at this new high speed — safely, steadily and with production advantages never obtained before.

These Norton cylindrical production grinders — now called the Series 8500, and so identified with a name plate — include the Type CTU Cylindricals, Angular Wheel-Slide grinders, No. 2 Centerless and the Type CP-1 PLUNG-O-MATIC®. Similarly, Norton high-speed wheels have been tested and approved for 8500 SFFPM and carry the new checkered-flag stencil.

*Remember: it took a great deal more than stepping up spindle speeds to assure the greater productivity of Series 8500 machines.*

Fluctuations in wheel energy, mechanical energy, tangential force and many other factors had to be carefully considered before final approval of designs.

As a result, Series 8500 grinders produce more pieces-per-hour at lower cost-per-piece . . . provide finer finishes for improved product quality . . . and their higher speed reduces wheel dressings for longer wheel life and lowered wheel cost.

### **For your surface grinding**

... Norton Type S-3 hydraulic surface grinders are now available with table speeds stepped up to a new high of 150 FPM.

This is another Norton achievement to bring you faster production than ever before. And, like the Series 8500, the Type S-3's are engineered to provide better production and product quality as a benefit of higher table speed.

Available in 6" x 18" and 8" x 24" sizes, Type S-3 surface grinders are fast and accurate on long production runs or toolroom grinding. They handle taller workpieces . . . are equipped for fast positioning, better sighting and loading . . . and their faster table speeds mean less heat damage to workpieces.

# **From Norton . . . Higher Speeds for Faster Grinding ... Cylindrical or Surface**



Learn how Norton developments are bringing more and more advantages of the speed age to many types of grinding. And call your Norton Man — a trained Grinding Engineer — for details on how these advantages can be brought to your own production. Or write to NORTON COMPANY, Machine Tool Division, Worcester 6, Massachusetts.

*District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.*

*Only Norton provides 150 FPM  
table speeds on surface grinders.*



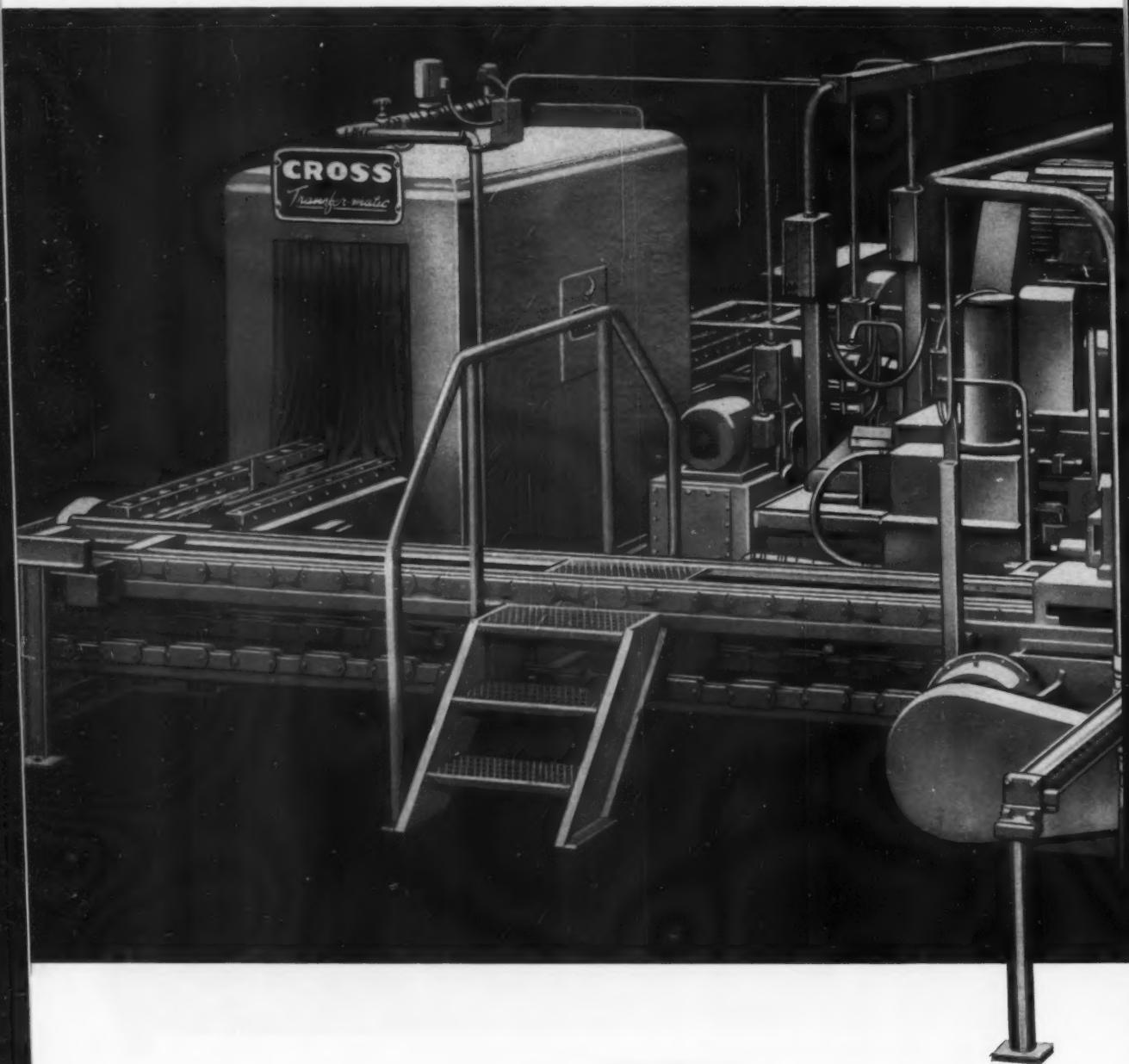
*Only Norton provides 8500  
SFPM wheel speeds on  
cylindrical grinders.*



*75 years of... Making better products  
...to make your products better*

**NORTON PRODUCTS:** Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes  
**MACHINE TOOL DIVISION:** Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines • Gear Induction Hardeners

## Completely Machines Tractor Axle Housings

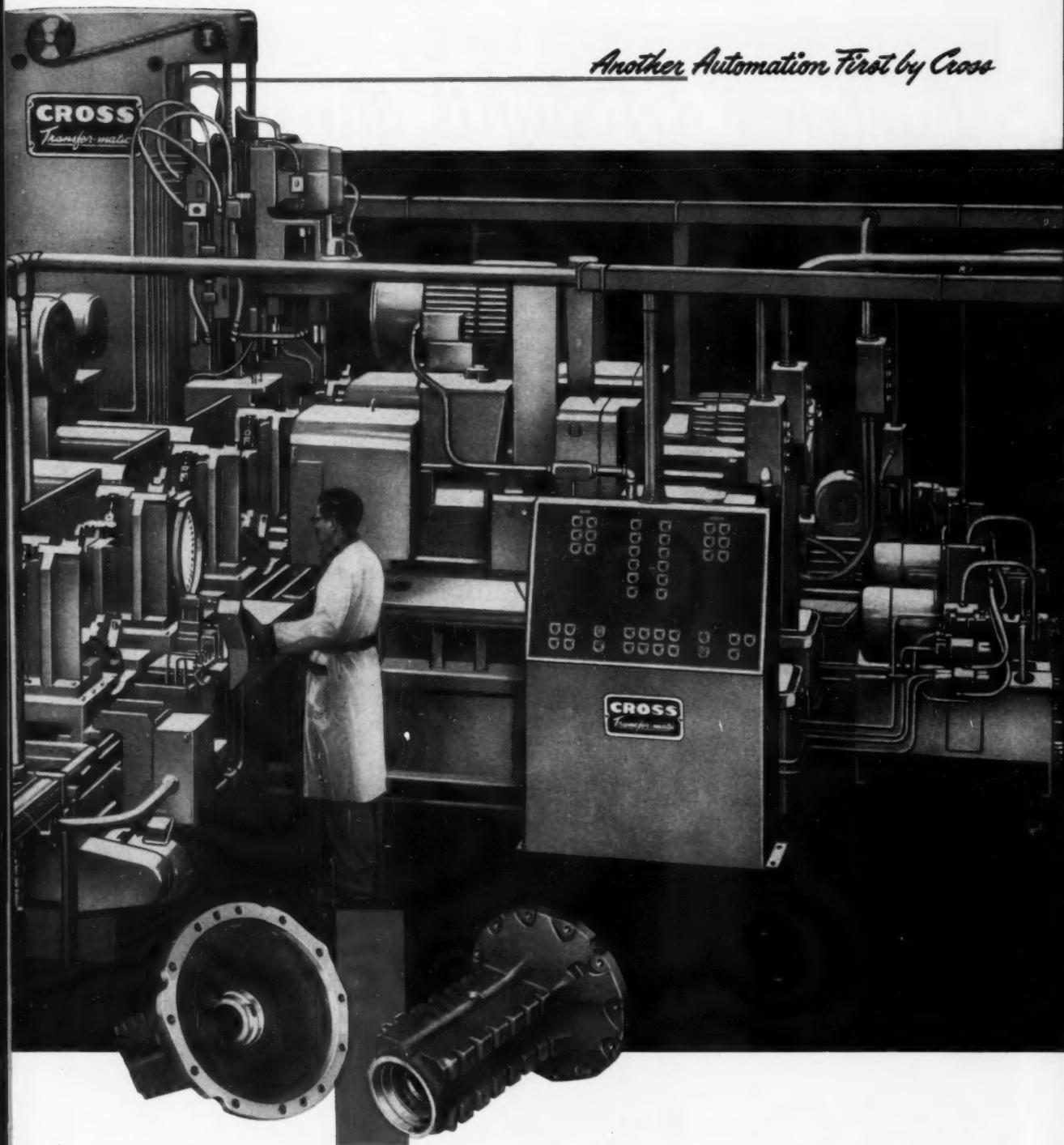


*Assures Concentricity  
and Squareness of  
Bearing Seats, Counter-Bore  
and Mounting Flange*

A significant breakthrough in processing of tractor rear axle housings has been accomplished by this new Transfer-matic which performs all machining operations.

An outstanding advantage of the machine is greater accuracy. Concentricity and squareness of the bearing seats, counter-bore and mounting flange are assured. Bore tolerances are  $\pm 0.0005$ . The concentricity, squareness, and center-distance tolerances between the bearing seats, faces and dowels is  $\pm 0.001$ . Close alignment between the two ends is maintained by doing all precision boring and the facing on both ends in one station.

*Another Automation First by Cross*



Four different housings weighing up to 175 pounds are processed with minor adjustments. Production requirements are up to 28 per hour for any of the four parts.

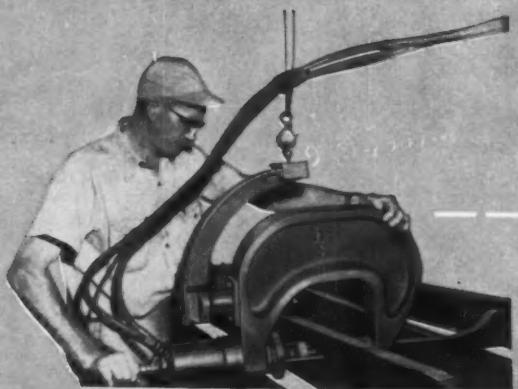
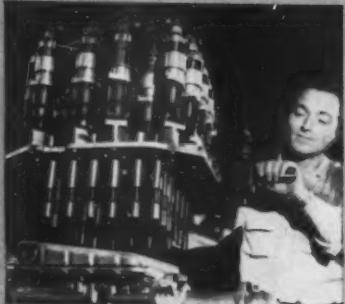
An unusual feature of the Transfer-matic is the use of two shuttle heads that index so that successive operations can be performed without moving the part. This design reduces the amount of capital investment required.

A Cross Sales Engineer will be glad to elaborate on these and other Cross developments.

Established 1898

THE **CROSS** CO.  
*First in Automation*  
PARK GROVE STATION • DETROIT 5, MICHIGAN

# *Fastener driving is our business..*



# UNIFORM...FAST...ACCURATE



## SCREWDRIVERS AND NUTRUNNERS

Air and electric models with conventional or "one-shot" torque control clutches—reversible or non-reversible—selection of handle styles—for threaded fasteners from #4 to  $5/8$ " diameter.



## IMPACT WRENCHES

Air and electric models with conventional and torque control clutches—reversible—selection of handle styles—for threaded fasteners from  $1/4$ " to  $1\frac{3}{4}$ " diameter.



## MULTIPLE NUTRUNNERS

Air-operated units custom designed for simultaneous installation of two or more threaded fasteners—with direct drive or "one-shot" torque control clutch—for fasteners from #4 to  $\frac{3}{4}$ " diameter.



## COMPRESSION RIVETERS

Air, hydraulic and air-powered hydraulic models—portable or stationary—for ferrous or non-ferrous, solid or tubular rivets from  $\frac{1}{16}$ " to  $1\frac{1}{4}$ " diameter.



## NAIL DRIVERS

Air-operated models for 4 penny to 60 penny straight or threaded shank nails.



## RIVETING HAMMERS

Air-operated models in wide variety of handle styles—for ferrous or non-ferrous rivets from  $\frac{3}{32}$ " to  $1\frac{1}{4}$ " diameter.



# Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

# WINTER ROCKET<sup>\*</sup> TAPS

FOR CHIPLESS  
FORMING OF  
INTERNAL THREADS

\* Patent No. RE 24,572

PLUG STYLE



BOTTOMING STYLE



# WINTER

Winter Brothers fluteless 'Rocket' Taps produce superior internal threads in materials such as aluminum, brass, copper, ductile steel and die castings by chipless forming rather than by cutting. Resulting threads are extremely accurate with an excellent burnished finish and maximum strength characteristics.

Because 'Rocket' Taps actually displace metal without removing it, no chips are formed to clog flutes and cause tap breakage. Blind hole tapping is easier, faster. The absence of a cutting action virtually eliminates resharpening and assures longer tool life. A stronger thread structure is

produced by compression and hardening of the metal without breaking surface fiber grains.

Stocked in all popular tap sizes, 'Rocket' Taps are available in both plug and bottoming styles from your local Winter Distributor. Call him today for complete information on this newest, cost-cutting tool from Winter Brothers. Or, write for our free, informative brochure on 'Rocket' tapping.

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CHOOSE FROM WINTER'S WIDE LINE OF TAPS, DIES AND GAGES



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# NATIONAL GUN DRILLS\*

FOR  
QUALITY  
HOLES

\*Patent No. 2,418,021

TARGET\* TYPE

CENTER-CUT TYPE

CENTER-CUT TYPE



TARGET TYPE



# National

**Target Gun Drills**, products of National's intensive research program, permit straighter, deeper drilling to closer tolerances than ever before. A solid core is formed that acts as a continuous center guide in the hole being drilled. Drilling performance and accuracy are vastly improved. **Center-Cut Gun Drills** provide peak cutting efficiency on certain applications such as blind-hole and interrupted-hole drilling.

**Gun Drill Shanks**, both tubular and solid types, are of special alloy steel heat treated to a tensile strength of 194,000 psi. They provide extra-long drilling life without twist or "wind up", even at higher speeds and feeds.

Gun Drills are manufactured in a complete range of standard stock sizes. Cutting heads of high speed steel, with carbide tips, or of solid carbide are available in brazed-on construction, as well as with National's convenient Quick-Change feature for fast resharpening and replacement. Gun Reamers, Controlled Core Gun Drills, Sharpening Fixtures and Point Checking Gages are also manufactured by National, your only source for tools *plus*!

**NATIONAL TWIST DRILL & TOOL COMPANY**  
ROCHESTER, MICH.

Distributors in principal cities. Branches in New York  
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\*JUST TWO OF NATIONAL'S PARADE OF PLUS PRODUCTS

TWIST DRILLS • REAMERS • COUNTERBORES  
END MILLS • MILLING CUTTERS • HOBS • GUN DRILLS  
GUN REAMERS • CARBIDE and SPECIAL TOOLS

CALL YOUR  
NATIONAL DISTRIBUTOR



## A LABORATORY IN JOHANNESBURG IS WORKING FOR YOU

Possibly you have never even heard of the Diamond Research Laboratory of Johannesburg. Yet its findings are of great importance to every user of industrial diamonds.

Established in 1947, the Diamond Research Laboratory is sponsored by Industrial Distributors (1946) Ltd. Its work is devoted exclusively to investigations on all phases of the diamond.

In its brief 13 years of existence, the Laboratory's developments have been of great significance. They include:

- increase in efficiency of natural diamond grit in resin and metal-bond grinding wheels
- considerable improvement in design and performance of diamond drill crowns
- development of electrolytic method of resharpening tungsten-carbide-tipped percussion drill bits
- development of diamond thermistors for highly accurate temperature measurements
- vector orientation, by X-ray, of diamond tool stones

Obviously, this intensive—and costly—research cannot be carried on by individual users of industrial diamonds. But Industrial Distributors, world distributors of natural industrial diamonds, has undertaken this responsibility for interested users throughout the world.

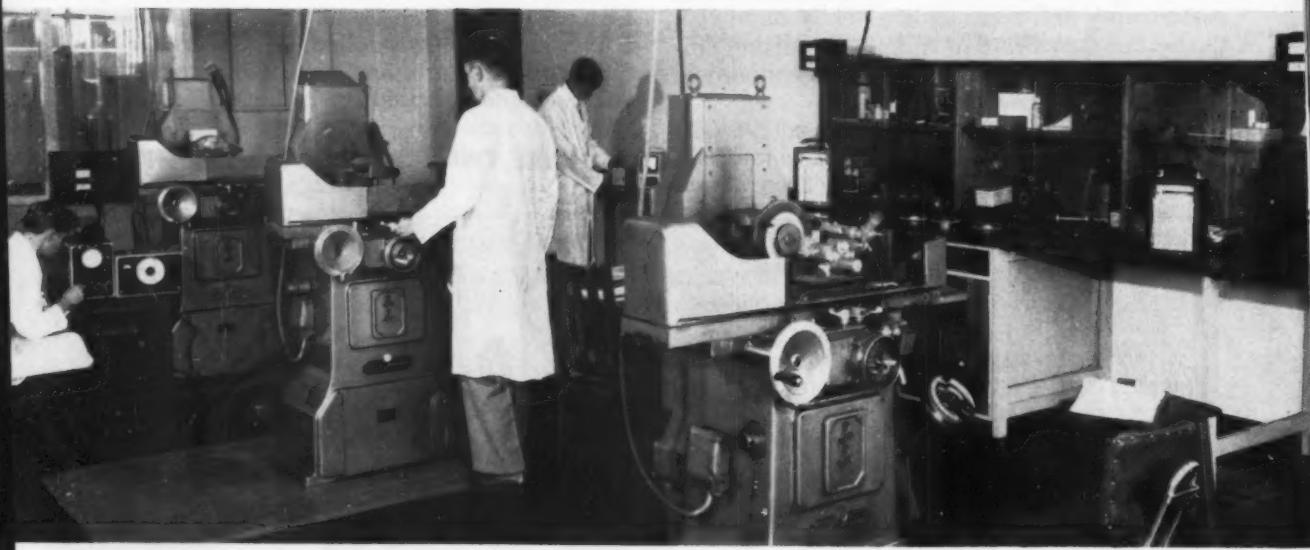
The Diamond Research Laboratory is in Johannesburg. But it's working for *you*.

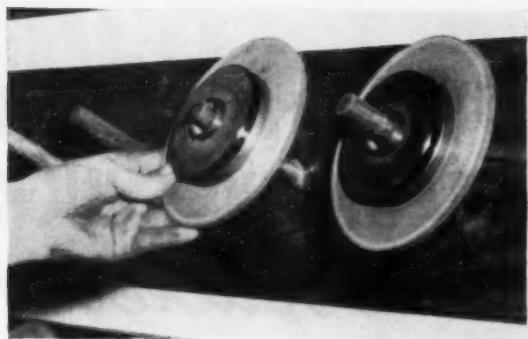


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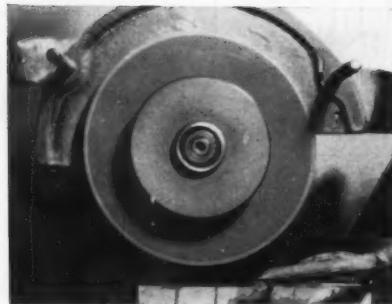
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*Resin-bonded diamond grinding wheels are tested in a carefully controlled experiment. In two years of testing, 450 separate wheels were used to grind away two tons of carbide.*





*A specially developed type of grit enables resin-bond diamond wheels to grind rapidly and efficiently.*

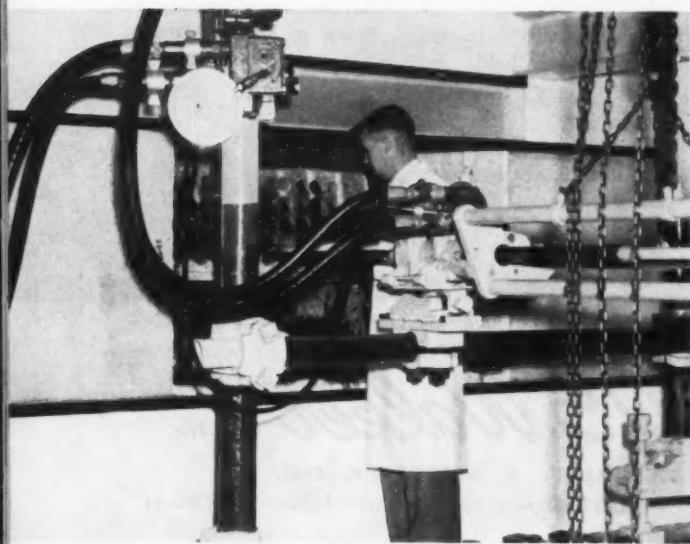


*A diamond abrasive wheel is tested at the Diamond Research Laboratory by surface grinding a block of tungsten carbide.*

*Staff member counts number of diamond grit particles which appear on the screen of a microscope. This instrument was especially developed for checking the shape of diamond grit.*



*Laboratory drilling machine tests the efficiency of diamond drill crowns in granite.*



**IF YOU ARE INTERESTED**

in the Laboratory's work, please fill in this coupon. You will receive a copy of this attractive booklet outlining the function and the findings of the Diamond Research Laboratory.

**DIAMOND RESEARCH LABORATORY**

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Union of South Africa

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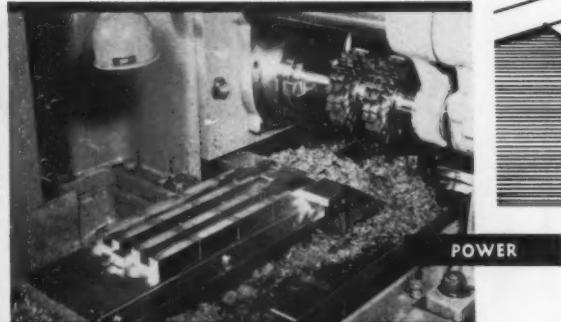
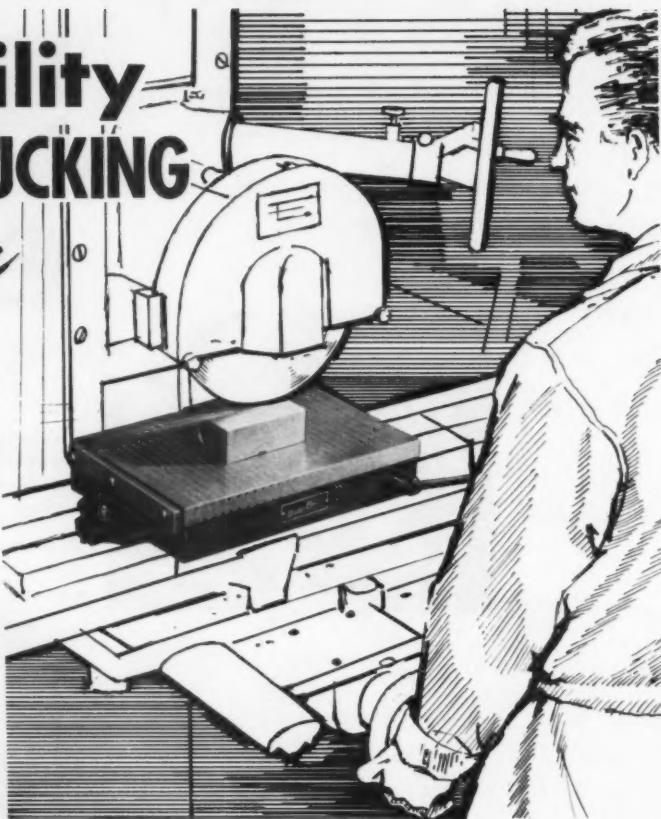
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# Dependability in MAGNETIC CHUCKING means *Walker*

Walker Ceramax permanent magnetic chucks are designed to give the day after day dependable, trouble-free performance that means the maximum use of production time. Ceramic permanent magnets, with three times the coercive force of ordinary Alnico magnets, maintain their strength indefinitely.



**Dependable power** is readily available for quick, easy holding of ferrous materials, enough power to make the Ceramax chuck adaptable to many milling set-ups. With new Ceramic magnets you can be sure the power is always there.

**Dependable versatility** results from the  $\frac{1}{4}$ " poles that permit holding both small and large work on the same chuck without the need for auxiliary top plates. New Ceramic magnets allow each pole to be uniformly and individually magnetized. Stock as thin as .020" can be securely held.

**Dependable accuracy** is illustrated by the fact that Ceramax chucks are used exclusively by Ex-Cell-O Corporation, Greenville Ohio plant, with the magna sine plate.

*When buying magnetic chucks, specify Walker.*

**O.S. Walker** Co., Inc.

ROCKDALE ST. • WORCESTER 6, MASS.

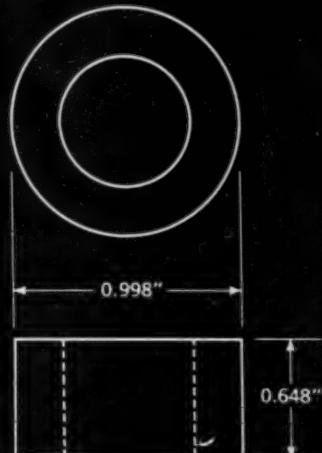
Original Designers and Builders of Magnetic Chucks

# NEW GRINDER TRIPLES OUTPUT

**Gardner 2H20 grinds more magnets in  $\frac{1}{3}$  the time**

In this installation it is grinding 3,966 #5 magnets—taking 3 passes on each part—in one 8-hour shift. This is more than the old machine was producing in three 8-hour shifts.

The new 2H20 is the latest addition to the Gardner 2H line of precision double spindle grinders.



Stock removal .030" per pass.  
Three passes per part.

**GARDNER**  
precision disc grinders  
Beloit, Wisconsin

# imagine

buying a **GRAY** planer for only

# \$30,660

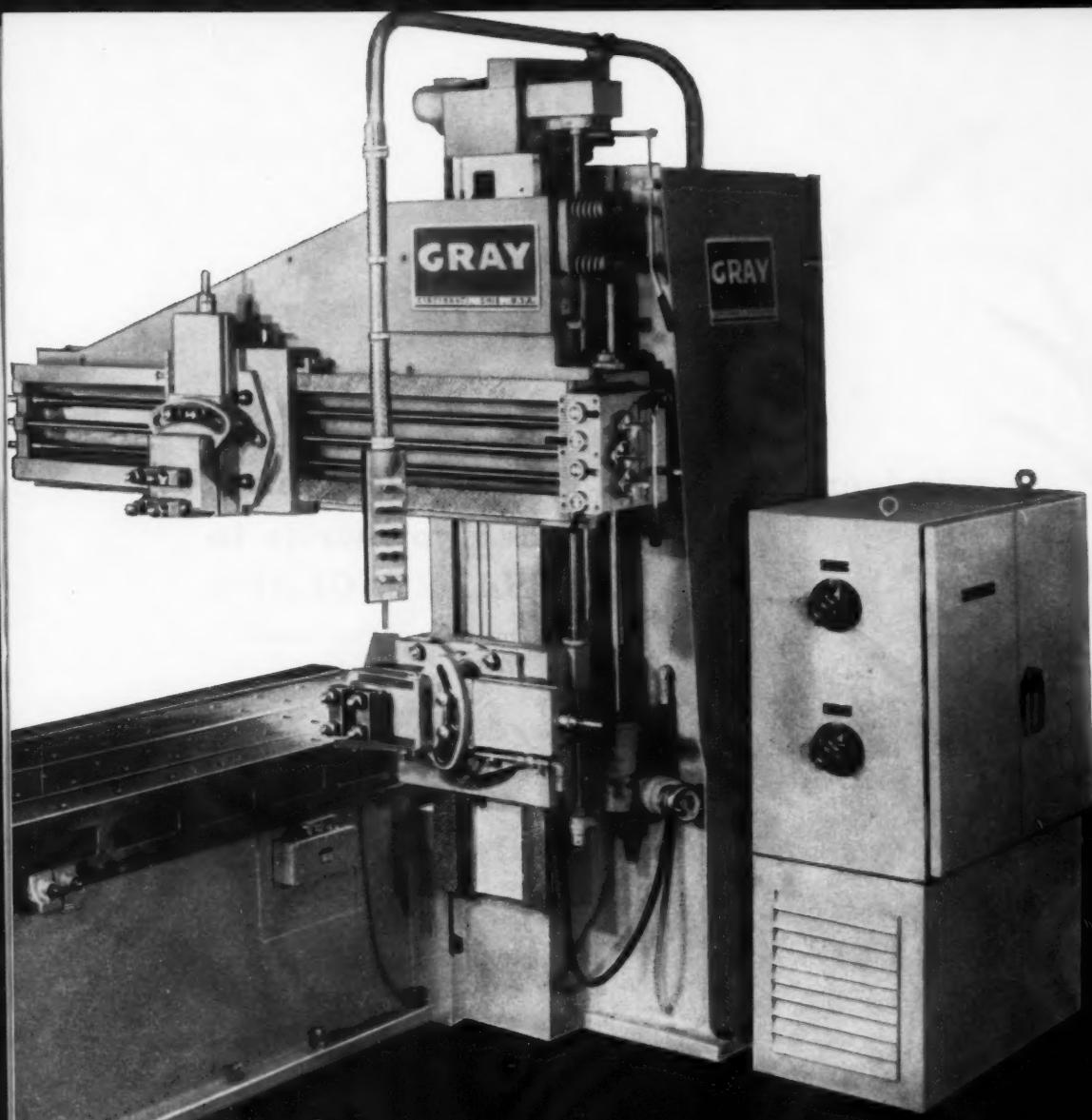
above basic price includes 30" x 6' planer, one rail head, electric drive and controls



- available with single or double-cutting heads ■ flush bottom bed
- new Gray knee ■ synchro-mesh table replacer ■ full pendant control of table
- Gray Safety nut ■ full floating drive shaft ■ quick acting saddle and slide clamps
- abutment tool aprons ■ non-shock pneumatic tool lifters ■ infinite feed range



**technical bulletin available**



## *the* **new** *30"-36"-42"* **flying scot**

- square locked throughout ■ knee and rail counterbalance ■ pyramid side walls on bed
- Vee ways ■ gray non-metallic ways—optional ■ maximum capacity—table width
- 'reservoir' lubrication ■ high table speeds ■ duplex tables optional ■ new column
- helicone transmission ■ space saver drive ■ table safety stop ■ forced lubrication

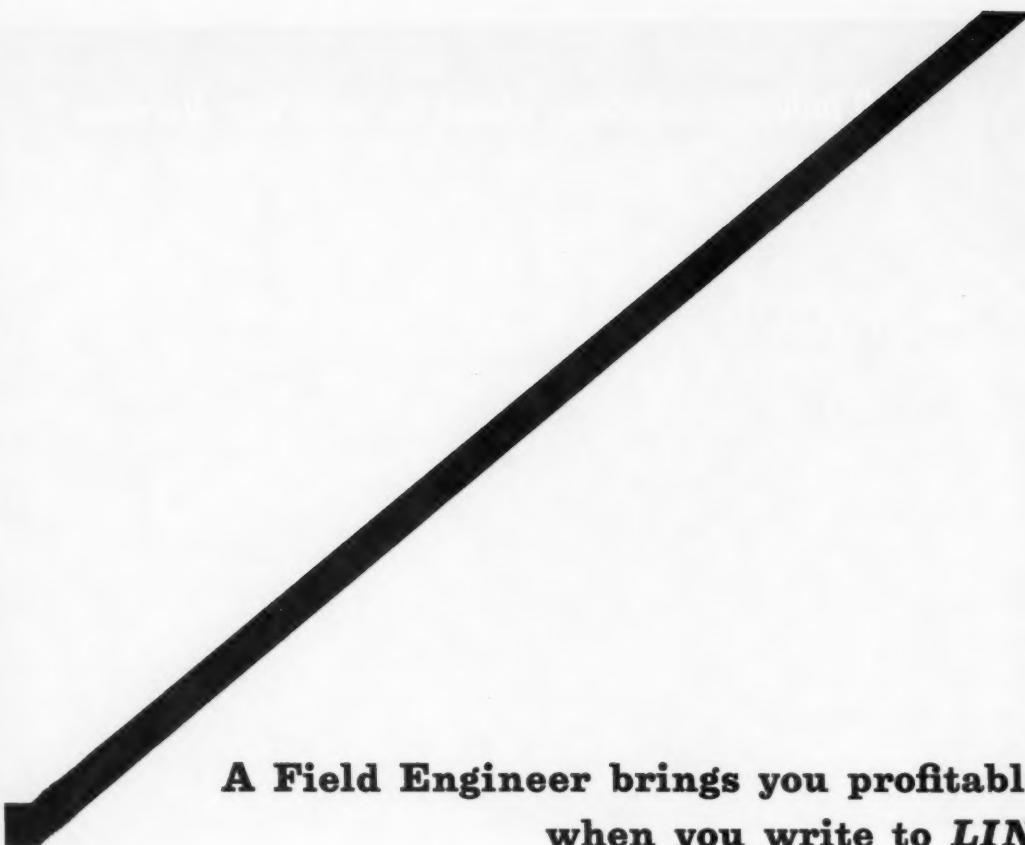
horizontal milling and boring machines  
planers  
planer type milling machines

**THE G. A. GRAY CO.**  
CINCINNATI, OHIO



**A reindeer brings you Season's Greetings  
when you write to  
SANTA CLAUS**

*(specialist in world peace)*



## A Field Engineer brings you profitable ideas when you write to **LINCOLN**

*(specialists in arc welding)*

WRITING to Santa Claus is an exciting experience for the whole family. Eager faces . . . pencilled lists . . . crackling fire . . . and the air alive with expectancy. And then the long, almost unending wait until Christmas, when miraculously St. Nick generally delivers even a little more than was desired. This is why we have faith in him. That's the spirit of Christmas!

Now, we don't say our Field Engineers will arrive in sleighs filled with toys, but this we can guarantee: if you write a letter to LINCOLN, the Field Engineer who calls will be able to give you a good deal more help than you expected. Not only does he know welding products but also the best procedure to use on each job. He understands how to relate welding profitably to your total manufacturing operation.

That's why so many companies who have had faith in LINCOLN for over fifty years say, "It's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a 'plus' at no charge."

Merry Christmas!

THE LINCOLN ELECTRIC COMPANY

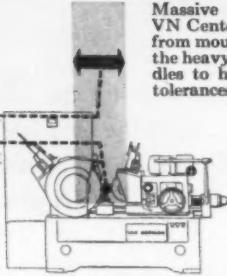
Dept. 2260 • Cleveland 17, Ohio

**LINCOLN**  
**WELDERS**

*All industry is talking about the new Van Norman*

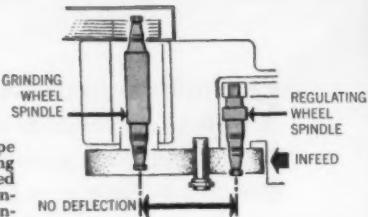


NO DEFLECTION  
HERE MEANS...  
MAINTAINED  
TOLERANCES HERE



Massive construction of the VN Centerless Grinder carries from mounting feet right up to the heavy duty, precision spindles to hold rigid production tolerances.

Heavy duty, unit type Grinding and Regulating Wheel Spindles, backed up by massive VN construction, assure maintained precision in the workpiece—no squeeze-out even during fast infeeding.



## NEW VAN NORMAN GRINDER TRIPLES

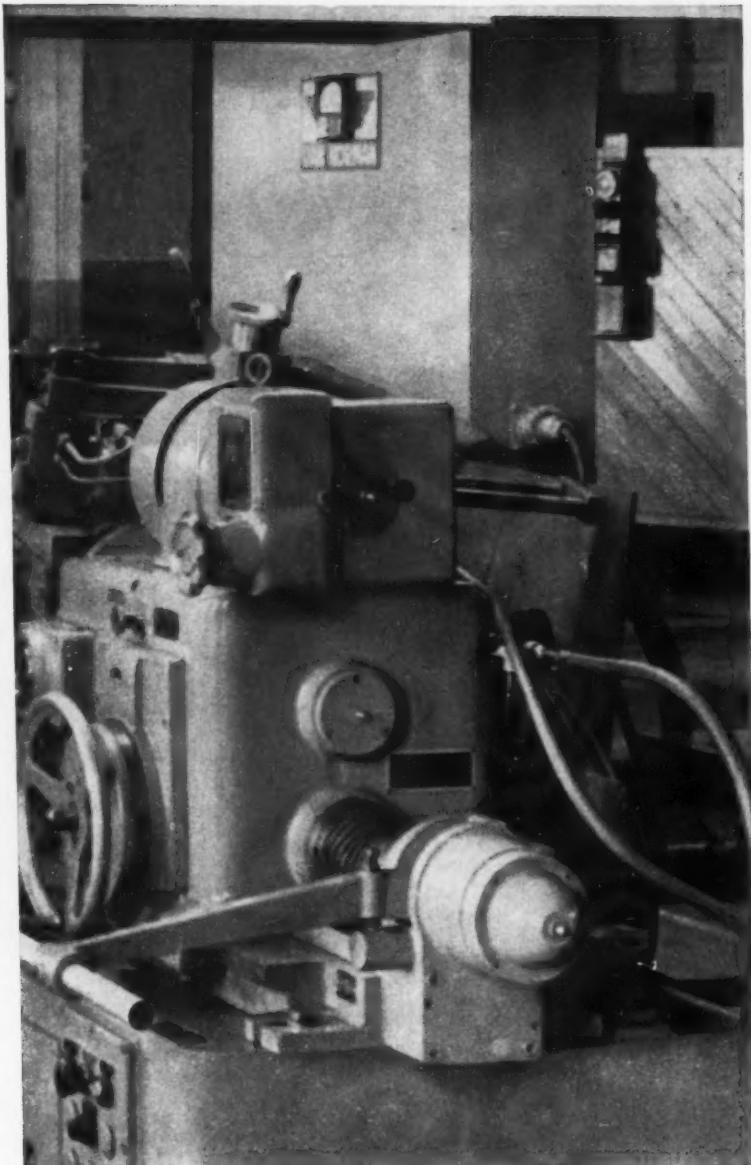
**VN 2C Centerless Grinders turn out famous cutting tools with spectacular speed,**

Production rates at Morse Twist Drill and Machine Co., in New Bedford, Mass., boomed when new Van Norman 2C Centerless Grinders were put to work. One of these rugged, heavy-duty machines actually combines the output of *three* centerless grinders! What's more—one man at Morse can set up and operate three VN 2C's simultaneously to turn out 5,000 precision-ground drills an hour. Previous box score: one man; one machine; only 800 drills an hour.

**300% Faster Output To Close Tolerances**—Work speed is hand-wheel regulated, gives an infinite RPM range to regulating wheel drive. The grinding wheel—large 24 x 8 x 12 inches—is profile diamond dressed, and increases machine efficiency by producing more pieces per dressing. Special tooling provides automatic operation for grinding with hopper feeding, and a unique unloading method. Traditional Morse quality is maintained by holding tolerances of 0.00025.

**VAN NORMAN**  
SPRINGFIELD 7, MASSACHUSETTS

MACHINERY, December, 1960



## PRODUCTION AT MORSE

**versatility, precision, economy**

**On Any Job, More Work Per Operator Per Work Shift** — with the fast, versatile, accurate, cost-cutting VN 2C Centerless Grinder. Thru-feed or infeed. Capacity 0" to 4 $\frac{1}{4}$ " diameter. Van Norman unit-type, anti-friction bearing spindles on both grinding and regulating wheels. Optional: VN Crush Dressing Attachment.

**Free Booklet**—"Centerless Grinding"—valuable guide to high production, lower costs. For your copy, contact factory or your local distributor.

**MACHINE COMPANY**  
A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

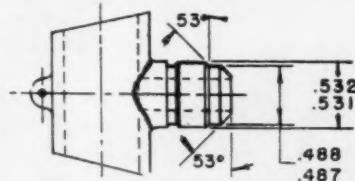
MACHINERY, December, 1960



For more data circle this page number on card at back of book

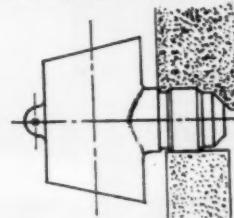
**Another typical  
Van Norman  
centerless grinder  
cost-saving  
application**

### CUSTOMER'S PROBLEM:



To produce parts to print at lowest possible cost, Van Norman was asked to suggest method of grinding .487/.488 diameter, .531/.532 thread diameter and 53° seal angle. These dimensions had previously been turned on screw machine without good results. Particularly the 53° angles which required that a 90% blue must be had when checked in a master gauge. Chatter and runout were the two major problems by the previous method.

### VAN NORMAN SOLUTION:



Using a VAN NORMAN Centerless Grinder, the part was ground. The part was first rough turned and formed to a straight diameter of approximately .535 and a 53° angle. Then, by using a VN Crush Forming Attachment, the wheel was formed to the desired shape, using a straight regulating wheel for support, plus a hold down to keep the part from tipping off the blade. The part was ground in one operation to desired size and finish.

### THE RESULT:

Operation was entirely successful. Several VN machines are now in operation on this job. Reports show the customer is producing parts at the rate of 240 pieces per hour at 100% efficiency, and are grinding up to 1500 parts per wheel dress. This is another typical cost-saving advantage of Van Norman Crush Forming.

# UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel—the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.



213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS



Floating Chuck



Standard Collet Chuck



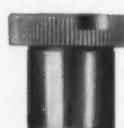
Mikro-Lok Boring Bar



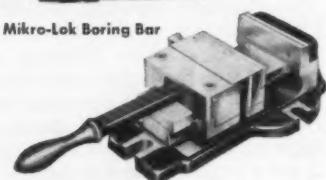
Boring Chuck



"Kwik-Switch"  
Tool Holder



Standard Drill Bushing



Wedge-Lock  
Production Vise

**UNIVERSAL ENGINEERING COMPANY,**

FRANKENMUTH 2, MICHIGAN



## Fastest way yet to cut straight bevel gears

If you're looking for a faster, fully automatic way to cut straight bevel gears and pinions with conjugate surfaces and localized tooth bearings, consider the Gleason No. 109 Straight Bevel Revacycle® Machine.

You rough, semifinish, and finish a tooth from the solid blank with a single rotation of the Revacycle cutter.

Now both 21" and 25" diameter cutters can be used on the No. 109 Revacycle Machine. The 25" cutter cuts gears to a maximum depth of 0.600".

The 21" cutter will cut to a maximum of 0.400".

A new, completely automatic mechanism loads and unloads each gear. You can feed this loader manually or with a conventional belt conveyor.

The No. 109 Machine handles a wide range of automotive and farm machinery gears: up to 10" diameter, 5:1 ratio, 1 1/4" face width.

Send for our bulletin for information on both the machine and the Revacycle Method.

*In Revacycle Method each blade of cutter is longer than its predecessor; there is no depth-wise feed of cutter itself. One rotation of the cutter completes each space from the solid.*



*Storage unit and flight conveyor can be fed manually or with belt conveyor. Even with manual operation, one operator can handle a battery of machines.*



**GLEASON WORKS**

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

FROM CREATIVE CRUCIBLE: HIGH SPEED STEELS THAT MAKE BETTER TOOLS POSSIBLE



**TO MAKE SURE A TWIST DRILL'S CUTTING EDGES ARE SHARP AND CLEAN**, an inspector measures its chisel angle, point angle and lip relief under the powerful lens of a precision instrument. Continually-improved Rex High Speed Steels help produce the fine edges so essential in twist drills.

## MORE HOLES PER DRILL

*Today's twist drills meet new standards for hardness, toughness and strength—because of continually improved Rex® High Speed Steels.*

Drills, the most heavily loaded cutting tools in metalworking, are now meeting even more exacting requirements. A matter of economics accounts for the new standards: because, *the profitability of the automated equipment in which the drills are being used depends solely on their performance.*

Twist drills that meet customers' strictest specifications—for hardness and toughness, for strength and precision—are being produced right now. They're available because of the drillmakers' continuing research and skill—combined with Crucible progress in making better high speed steels.



**TWIST DRILLS** made of Rex High Speed Steels consistently meet the drillmakers' exacting tests for hardness.

**To produce the fine steels needed for twist drills,** Crucible tool steel specialists now use the most advanced electronic instrumentation available. For example: they can record the temperature of the molten metal in the melting furnaces within 5 seconds. So, each heat is produced under identical temperature conditions.

**Crucible specialists employ new techniques** that also greatly improve deoxidation of the liquid steel. They use new ingot mold designs to minimize segregation. And they ultrasonically inspect every billet of Rex High Speed Steel before rolling or forging to ensure freedom from internal voids, flake, inclusions, etc.

For complete information on how Rex High Speed Steels can help make precision tools better, call or write the Crucible branch office or service center near you.



**BETTER TOOLS, THROUGH BETTER STEELS.** Constant improvement of Rex High Speed Steels ensures the increasingly better performance of hobs, taps, broaches and cutters—as well as twist drills.



**CRUCIBLE STEEL COMPANY OF AMERICA**

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# 3 OR 30,000 PIECES

**Cut them off MORE ACCURATELY  
at LOWER COST and FASTER on a**  
**MARVEL Hack Saw**



## **1. Accuracy? 2. Speed? 3. Low Cost?**

Which is most important in your production or intermittent cutting-off operations? You get all 3 when your work is handled on a MARVEL Series 6A or 9A Heavy Duty Ball Bearing Hack Saw. Whether you're cutting 3 or 30,000 identical pieces, you can be certain that each piece will be true . . . that it will be cut-off quickly, and at the lowest possible tool cost.

MARVEL Hack Saws are fine machine tools, with all the built-in accuracy this description implies. Designed to operate at higher speeds, with the heaviest feed pressures, they have almost unlimited power and stamina to stand up to the most severe service.

MARVEL Hack Saws are truly multi-purpose cutting-off machines. No run is too short or too long, no material too mild or too tough to be accurately and efficiently cut-off on a MARVEL Hack Saw.

Catalog C85 has complete details, facts and figures on both Marvel metal cutting Hack Saws and Band Saws. Write for it today.

5-1306

**ARMSTRONG-BLUM MFG. CO.**  
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

**MARVEL** Metal Cutting  
SAWS  
Better Machines-Better Blades

# PRODUCTION POINTERS

from

# GISHOLT

More  
cost-cutting  
IDEAS—  
to help  
you

## HOW IHC SUPERFINISHES BEARING RACES 300% FASTER

### Superfinisher® with automatic work handling cuts time, improves quality

Here is an excellent example of how new equipment, properly applied, offers dramatic cost and time savings. In use at International Harvester's West Pullman Works, Chicago, Illinois, this Gisholt Model 79A Bearing Race Superfinisher handles tapered inner bearing track surfaces on a wide variety of inner bearing races,  $2\frac{1}{2}$ " to maximum O.D. of  $4\frac{3}{4}$ ".

Here is the operation on an inner bearing race with a  $12^{\circ}$  taper and a

$2\frac{1}{8}$ " bore. Ground parts are placed in a gravity loader. A pocket wheel indexes the work to chucking position. The tailstock moves the part over an arbor for chucking in the I.D. The Superfinishing stone engages the outer track surface. At the end of the automatic cycle, the stone and tailstock retract, and spring-loaded pins eject the part. The pocket wheel indexes a new workpiece into position, at the same time discharging the finished part. F.t.f. time, 10 sec.

Different part sizes are accommodated by adjustment of loader tracks and replacement of the pocket wheel,

arbor sleeve and Superfinishing stone. The quill is adjusted for angle and diameter. Separate sets of dial controls adjust spindle speed, stone pressure, reciprocation rate and stone contact time.

*Superfinishing eliminates one grinding pass, provides better surface faster. Former methods required two grinding passes—the second to bring the surface from 60 to 25 micro-inches RMS in 25 sec. Next the races were Superfinished to 8 micro-inches RMS in 30 sec. Now the races are Superfinished from 60 to 8 micro-inches RMS in only 10 sec.*

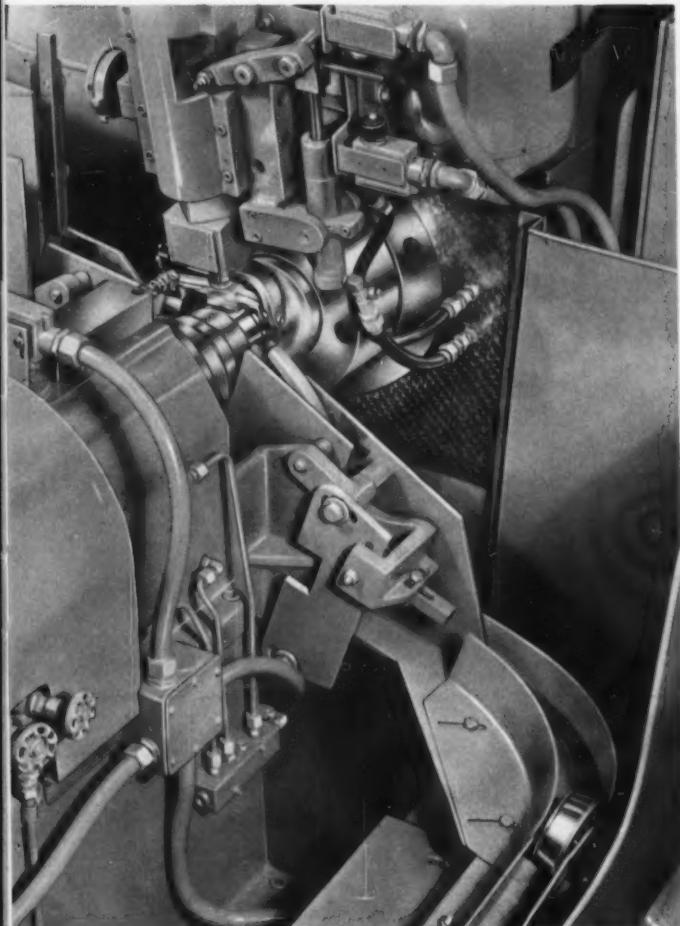
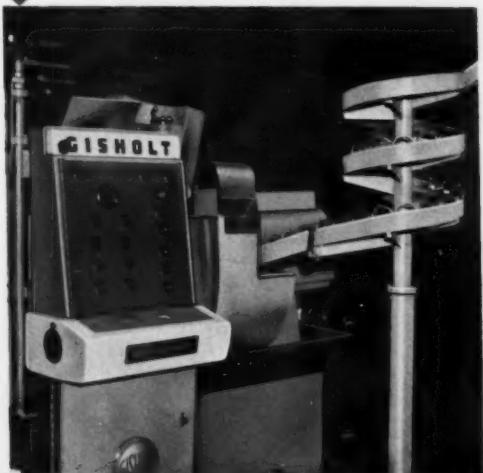
View from rear of machine showing Superfinishing stone engaging workpiece and Superfinished part in discharge conveyor.

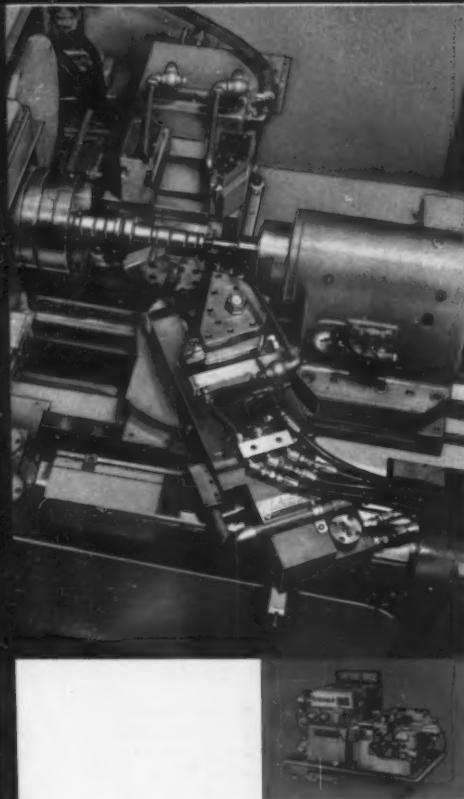


Rough workpiece at top. Superfinished part at bottom has a "controlled" 8 micro-inch RMS finish after fast, 10-sec. Superfinishing operation.

For information on Superfinishers circle or write in No. 736 on inquiry card.

MASTERLINE® 79A Bearing Race Superfinisher. Note dial controls at left which govern basic machine functions and speed setup. Gravity loader holds number of rough parts. Full automatic operation frees operator to handle additional units or perform other work.





## EASY WAY TO HANDLE STEP SHAFTS

### Speeds setup, reduces inspection, cuts tool costs

Step shaft jobs couldn't be easier when you've got a No. 12 Automatic Production Lathe with a multiple-pass JETracer® operating within the automatic cycle.

All the work on the step shaft shown (12½" x 2¾") in the setup photo is completed in just two 4-pass operations.

Operation 1, on one end, takes just 5.0 min., f.t.f. Operation 2, shown — only 4.9 min., f.t.f.

JETracer, operating within automatic cycle of No. 12 Automatic Production Lathe, makes short work of stepped shaft job. Second operation shown. The JETracer handles the stepped diameters and contours, using four different templates for each operation. Necking, grooving and chamfering are completed from the rear independent slide.

For information on JETracing, circle or write in No. 737 on inquiry card.

The JETracer, mounted on the front carriage, has a 4-pass automatic indexing template carrier. An automatic indexing tool post on the JETracer slide presents a roughing tool on the first three passes, then a finishing tool on the final pass.

To handle similar parts requires only a change of tracing templates and grooving tools, and chamfer tool adjustments. Many shaft jobs may be completed in just two passes for each end. With such a setup, four templates would be used and the work turned end-for-end after the second pass. The entire part could then be completed in one machining cycle—eliminating the need for the banking of parts.

**Rigidity and automatic cycle of No. 12 Automatic, combined with efficiency of multiple-pass JETracing, assure accuracy and economy.**

## UNIQUE AR® ADVANTAGES BOOST SMALL-LOT EFFICIENCY

### Setup demonstrates combination of advantages offered for first time in ONE machine

Now for the first time the No. 5 AR Turret Lathe gives you the efficiency and consistent accuracy of automatic cycling, plus the versatility and quick setup of a hand-operated ram type turret lathe. And it handles BOTH BAR AND CHUCKING WORK. Take this 1" valve bonnet job, for



example. First operation (A) is a bar job; second (B), a chucking job. While both operations could easily be done on one AR—converting from bar to chucking in one hour or less—the volume of work here warrants the use of two AR's: one for bar work, the other for chucking.

All external and internal surfaces in area A are machined in the first operation in only 3.3 min., f.t.f. An Air-draulic bar feed allows feeding of the 2½" bar stock right up to the collet pads.

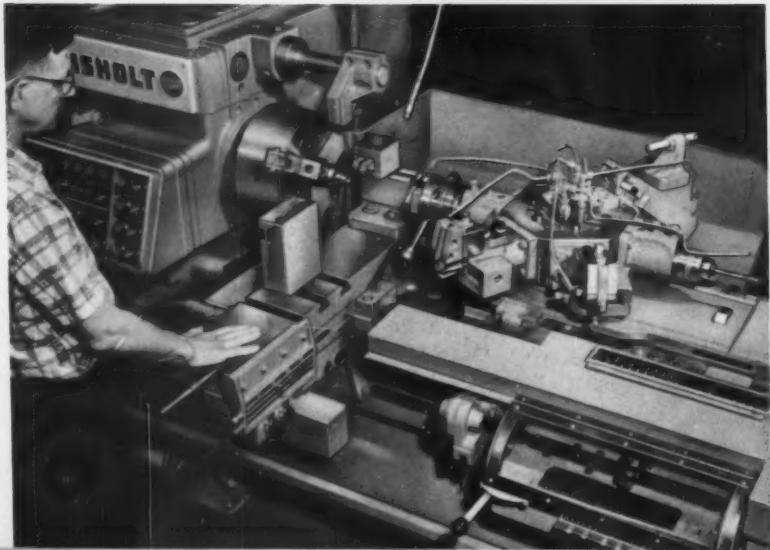
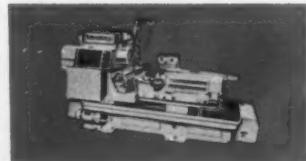
Tooling for the second operation (chucking) is shown. All internal and

external surfaces in area B are completed in only 2.1 min., f.t.f. Operations handled during the automatic cycle include: deep hole drilling with automatic chip clearing; internal and external threading; internal recessing; dwell for cleanup, and reverse feed for fine finish. Many of these operations would require a highly skilled operator if done on a hand-operated machine.

One operator easily handles two AR's—one for bar work, the other for chucking work. He keeps bar stock supplied on one, chucks and unchucks on the other, and removes finished parts.

**AR (Automatic Ram) Turret Lathe averages 50% boost in productivity—extends tool life—assures consistent, close-tolerance quality.**

For information on AR, circle or write in No. 738 on inquiry card.



## AUTOMATIC 10-STEP BALANCING ELIMINATES CHANCE OF HUMAN ERROR

### Cycle includes measurement and location of unbalance, correction and inspection

Perhaps you can take advantage of the principles involved in this automatic balancing setup used by a well-known automotive manufacturer. Here two automatic Gisholt 2U Balancing Machines are an integral part of the crankshaft machining line.

Each machine is furnished with a ring (bob) weight eliminator, which offers considerable savings in tooling costs and work-preparation time—and two Leland Gifford multiple-spindle drilling units.

The crankshafts are manually loaded and unloaded. Balancing machine operation is completely automatic. In one continuous cycle it measures the amount and location of unbalance in each of two correction planes. It indexes to the exact angles for correction drilling and then inspects to assure balance within the  $\frac{1}{2}$  ounce inch tolerance.

Gisholt Automatic 2U Balancer setup measures amount and locates angle of unbalance in each of two correction planes, corrects by drilling, and inspects for balance in one, 100-second, automatic cycle. Note multiple-spindle correction drilling units to right of operator. Operator loads and unloads, couples and uncouples the drive.



If unbalance exceeds the maximum correction that can be made in one drilling, if unbalance falls outside the sectors in which correction can be made, or if residual unbalance exceeds tolerance, the machine stops and a signal light goes on.

A manual operation switch then permits the operator to reinspect the workpiece and make the necessary balancing correction.

The entire automatic sequence can be completed for the average part in 100 seconds, so the operator has ample time to handle two machines.

*Two operations for locating, measuring, correcting and inspecting for balance are quickly performed in one automatic cycle—eliminating human error, assuring that balancing tolerances are uniformly met on every part.*

For information on balancing machines, circle or write in No. 739 on inquiry card.

## NOW CRI-DAN OFFERS TRACING AND THREADING TO CUT YOUR COSTS

### Single-point ceramic tracing and carbide threading operations combined in automatic cycle for top efficiency

This part, an accumulator cap of 1040 steel, was previously rough- and finish-machined, and then threaded, using collapsible die heads. It is produced in two different sizes. The manufacturer wanted to eliminate problems of holding size and meeting fine surface finish requirements. He also wanted to combine machining and threading on an automatic, and reduce tool, die and setup costs.

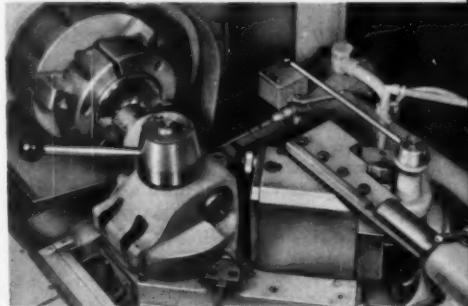
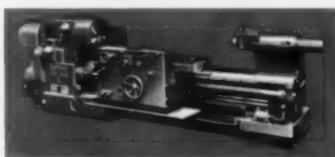
The answer, provided by a CRI-DAN E Automatic Threading Lathe, may help you in your own work. The illustrations and captions tell how the CRI-DAN handles contour-tracing and threading far faster than by previous methods.

**CRI-DAN E cuts time—combines tough internal contour-tracing and threading jobs in automatic cycle. Change-over for two part sizes takes approximately 15 min.**

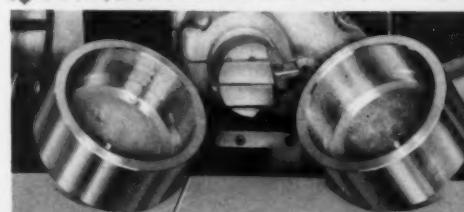
For information on CRI-DAN E, circle or write in No. 740 on inquiry card.

The part shown,  $6\frac{1}{4}$  " diameter,  $4\frac{1}{8}$  " long, arrives at CRI-DAN rough-machined. It is held in special jaws to eliminate distortion. A triangular insert-type ceramic tracing tool is used, starting at the face, to face, chamfer, bore I.D., under-cut thread relief, bore seal diameter and face bottom of seal diameter. A machining speed of 700 to 800 s.f.m. produces a 50 micro-inch RMS finish on all surfaces. Triangular inserts provide six cutting edges with 12 pieces completed per edge.

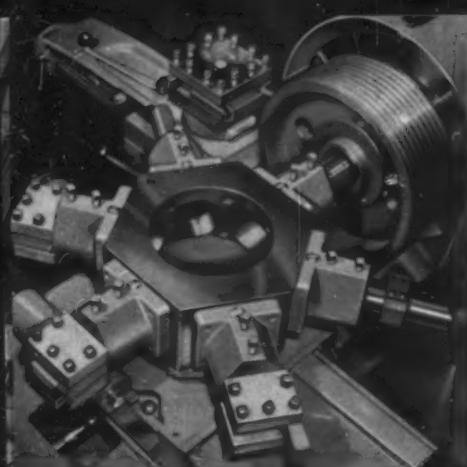
The  $1.450$ "-long,  $5.375$ "-diameter, 16 NS-2B thread in the bore is then completed in 12 passes (.0015" in feed per pass) by the single-point carbide threading tool. Note that both the tracing and the threading tools are mounted in the same holder. The thread is machined from the right-hand side of the part—starting at the base of the bore and feeding out to the face of the work.



Close-up of the work and tooling. At right: ceramic threading tool and part showing surfaces traced. At left: carbide threading tool and thread produced in 12 passes.



**ASK YOUR GISHOLT REPRESENTATIVE  
ABOUT FACTORY-REBUILT MACHINES  
WITH NEW MACHINE GUARANTEE**



**First operation setup.** Cross-feeding hex turret tools bore, turn, recess, face, chamfer and groove I.D. Square turret tools turn the O.D., face, chamfer and single-tool the V-belt grooves. Time, 73.9 min., f.t.f. Second operation is the same as the first except for grooving and boring. Time, 33.4 min., f.t.f. One set of tools handles both operations. Reversible chuck jaws speed change-over.



## CROSS-FEEDING HEXAGON TURRET CUTS SMALL-LOT TOOLING COSTS

### Full-swing side carriage permits handling larger work on less costly machine

Two important cost-cutting advantages are obtained by this setup on a Gisholt MASTERLINE 3L Saddle Type Turret Lathe:

1. A cross-feeding hexagon turret cuts tooling costs and reduces setup time for short-run work;
2. A full-swing side carriage (standard) permits swinging work up to 21 $\frac{1}{4}$ " diameter over the cross slide on the less costly 3L size machine.

You'll want to remember the way these advantages are used to machine 20 $\frac{1}{4}$ " diameter, 7" wide cast iron V-belt pulleys in two operations.

Standard boring bars and cutter holders are mounted on the cross-feeding hex turret. These are used to bore, turn, face, recess, chamfer and

groove I.D. One set of tools is used for both operations. A 6-position stop roll for the cross-feeding hex turret assures repeat accuracy on all cuts.

The full-swing side carriage permits moving the cross slide right up beside the almost maximum diameter part as square turret tools turn the O.D., face, chamfer, and machine the V-belt grooves. The nine grooves are single-tooled to eliminate distortion and provide a fine finish. The side carriage stop bar has special notches that assure accurate spacing of grooves with minimum operator effort.

**Cross-feeding hex turret allows standard tools to handle multiple operations. With a taper attachment or JETracer control, even greater versatility can be obtained at minimum cost.**

For information on saddle type turret lathes, circle or write in No. 741 on inquiry card.

## ONE TAPE-CONTROLLED FASTERMATIC® OUTRUNS SIX OLDER MACHINES

### Cuts f.t.f. time 85%, cuts setup time 68%, assures consistent accuracy

Imagine the savings on your short-run jobs with a setup like this in your shop. It combines the automatic cycle of a versatile Fastermatic Automatic Chucking Turret Lathe with the fast setup and small-lot flexibility of point-to-point, punched-tape PRODAC control. Westinghouse Corp., Motor and Control Division, Buffalo, New York, is the user.

Here the operator sets his tools, inserts the tape in the reader, takes his trial cuts, makes his final tool adjustments, and starts the automatic cycle. Hand setting of stops and trip dogs, and selection of spindle speeds, feed rates and machine functions, are eliminated—all having been programmed on the tape.

The tape-controlled Fastermatic used by Westinghouse handles a great variety of work formerly re-

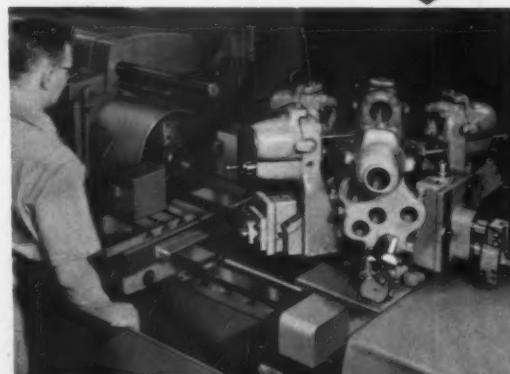
quiring six machines. Consistent production rates, long tool life and uniform quality are important benefits.

**IF Fastermatic, with point-to-point punched-tape control, outproduces six older machines on variety of small-lot work. Engineering department has complete control; operator-influenced variables are eliminated.**

For information on punched-tape PRODAC-controlled Fastermatic, write in or circle No. 742 on inquiry card.



Setup used by Westinghouse for machining two sides of nodular iron commutator V-rings, 4 $\frac{1}{2}$ " diameter, 1 $\frac{1}{8}$ " wide. Point-to-point, punched-tape PRODAC-controlled Fastermatic cuts previous setup time 68%, cuts f.t.f. time 85%. (Below) Rough ring and both sides of finished part. One side machined from hex turret stations 1 and 2, and front cross slide. Other side handled from stations 3 to 6, and rear cross slide. Total f.t.f. time, just 4 $\frac{1}{4}$  min.



The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers

Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products



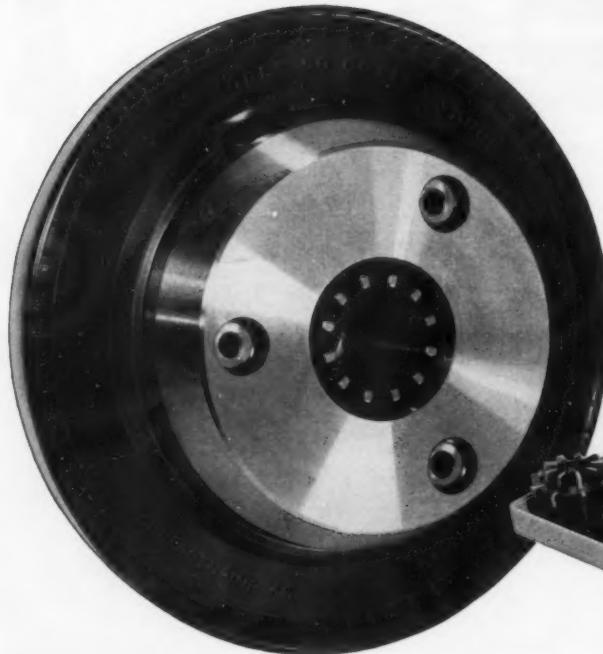
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# GISHOLT

MACHINE COMPANY  
Madison 10, Wisconsin, U.S.A.

# New MODEL 50 equips your lathes to do a lot more for a lot less!



**\$70<sup>00</sup>**

for the chuck

**\$65<sup>00</sup>**

for the collets



THE WORLD'S MOST MODERN COLLET CHUCK

Designed expressly for ATLAS, CLAUSING, DELTA, LOGAN, SHELDON, and SOUTH BEND LATHES

These and others of similar power and capacity now give top performance when equipped with the new Jacobs Model 50. Improve performance of your lathes. Increase spindle capacity as much as 42%. Get greater accuracy and stronger grip. It's easy and inexpensive with new Model 50 and its companion Rubber-Flex collets.

## CONSIDER THESE FEATURES . . .

### • Gripping Power

Model 50 is made for heavy duty turning. It has tremendous gripping power.

### • Accuracy

Model 50 is factory tested—maximum runout .001" T.I.R. at the nose when properly mounted.

### • Thin Walled and Fragile Work

Always parallel Model 50 Rubber-Flex collet jaws permit chucking of tubing and fragile materials without crimping or scoring.

### • Range

The 10 Rubber-Flex collets in the 500 Series, developed especially for use with Model 50, cover a greater bar stock range than 63 old-fashioned steel collets. You can chuck any bar between 3/32" and 1-1/16" with this set of 10 collets.

### • Capacity

Model 50 eliminates capacity-wasting draw bar. You can increase spindle capacity up to 42%.

### • Adapters

Model 50 adapters are fully machined for immediate mounting. Available in all popular threads and American Standard L00 taper.

### • Price

Model 50 prices are revolutionary!

**\$70.00** for the chuck.

**\$65.00** for the complete set of 10 collets.

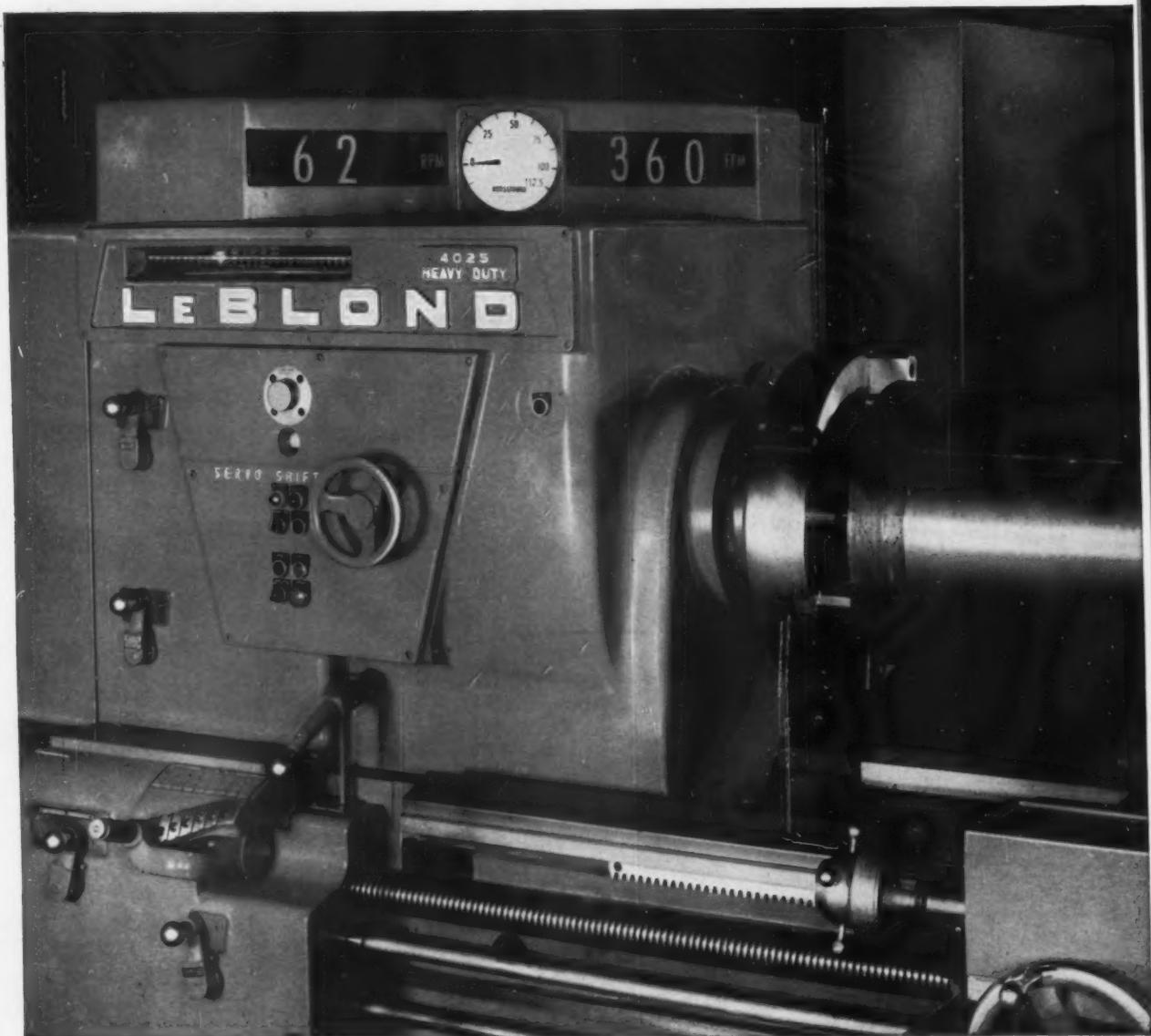
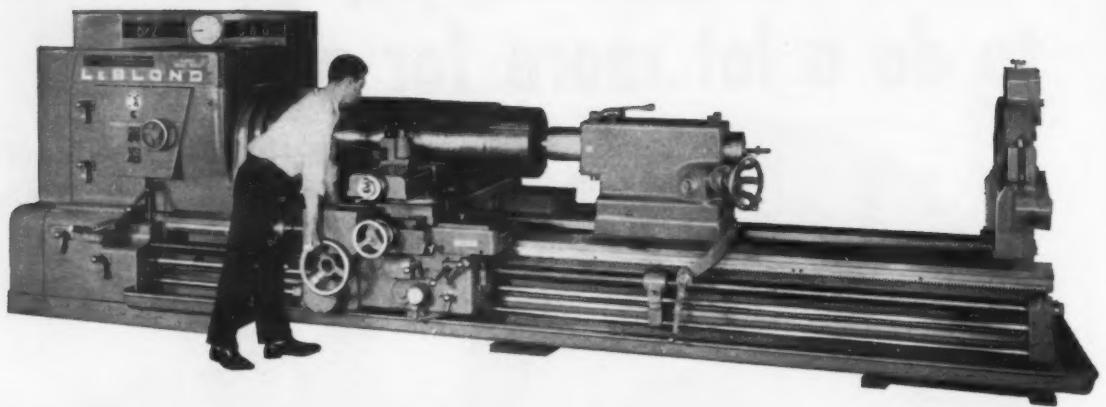
MODERNIZE YOUR LATHES WITH JACOBS MODEL 50 AND RUBBER-FLEX COLLETS. YOU CAN'T AFFORD NOT TO!

See your Jacobs industrial supply distributor. Give him the opportunity to prove these fantastic facts with a convincing demonstration at your desk! Call him today.



**Jacobs**  
**CHUCKS**

The Jacobs Manufacturing Co., West Hartford 10, Conn.



THE R. K. LeBLOND MACHINE TOOL CO. *World's Largest Builder of a Complete Line of Lathes*  
Cincinnati 8, Ohio

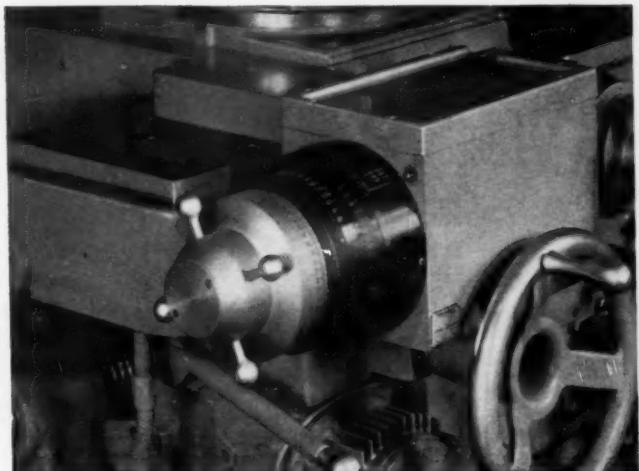


# SERVO-SHIFT

BY

## LEBLOND

*More Production with Less Effort*



*You'll never need an operator with blacksmith muscles and an adding machine mind!*

**TOUCH A BUTTON** on the carriage: This new LeBlond 4025 Heavy Duty slows, shifts, and picks up speed again in a new gear range, automatically. That's Servo-Shift doing the heavy work. No running to the headstock. No straining at balky levers. No wasted time.

**TURN THE DRUM DIAL** on the carriage to preselect spindle speed or surface speed. Set one, you automatically get the other for any diameter, fed in automatically from the gear train and cross slide position. No slide rules needed. No calculations. No errors.

**BIG ILLUMINATED NUMBERS**—Digital Readout—show sfm and rpm atop the lathe where everybody can see what's going on. No question now about when to push the Servo-Shift button for the next speed range. This readout tells. You get the cutting rates you specify. Rates you can plan on.

**IT'S ALL NEW**, right down to the sensible bed that slides chips out the back for easy clean up, and the remotely shifted gear train that provides 36 speeds in geometric steps from 5 to 600 rpm—6000 sfm at the periphery of a 40" diameter workpiece. Everything's safety interlocked by a closed loop system to prevent any chance of gear damage, important with 75 hp.

And under the electromechanical wizardry, this LeBlond 4025 (and other models to come) is as fine a heavy-duty lathe as money can buy. You'll assign it the big work, heavy shafts, roll turning jobs with or without a LeBlond 90° tracer, and you'll value the way it speeds production. Ask your LeBlond representative about the LeBlond 4025 Servo-Shift today.

Denison, Denison HydroOILics, and Multipress are registered trademarks of Denison Eng. Div., ABSCO



How **HEWLETT-PACKARD**  
marks instrument panels faster,  
for less with **DENISON** Multipress

# MARKING



**MARKING INSTRUMENT PANELS** with 50-ton (left) and 125-ton Denison hydraulic Multipresses at Hewlett-Packard Company, Palo Alto, California. Multipress saves 8 to 10 times the cost over former marking methods. Completed, typical panel is shown at left.

**MARKING** instrument panels with Denison hydraulic Multipress is saving Hewlett-Packard Company 8 to 10 times the cost of previous hand engraving methods which proved too costly, too slow.

These problems were solved—and marking costs greatly reduced—with installation of two Denison hydraulic Multipresses.

*The presses are operated at pressures from as low as 50 lbs. to a maximum of 125 tons with control of stamping depth to within .001"—evidence of extreme precision and versatility. Hydraulic press marking also allowed use of a less expensive aluminum stock which substantially reduced raw material cost.*

Hewlett-Packard's savings are typical of how Multipress can do hundreds of presswork jobs better and save you production money. Ask the Denison Production Specialist near you about a Multipress Analysis Program in your plant. There's no cost to you. He'll welcome working with you to **M A P** new ways to speed, improve and lower the cost of your press operations.

**DENISON ENGINEERING DIVISION**  
American Brake Shoe Company  
1152 Dublin Road • Columbus 16, Ohio

HYDRAULIC PRESSES  
PUMPS • MOTORS • CONTROLS

**DENISON**  
HYDRAULIC MULTIPRESS

This 30-spindle Kingsbury has 12 units, eight on the center column and four on wing bases. A 63-inch index table holds nine work fixtures. Each has power clamping and unclamping with rams mounted on the center column and operated by an air cylinder.

## Whirlpool combines

# 30 operations on one Kingsbury

*420 parts per hour gross  
with 8.6 second time cycle*

This machine for Whirlpool bores, counterbores, chamfers, drills and reams in one chucking of the work.

You can do this too and save money. A Kingsbury may not cost as much as you think, because it can replace several general-purpose machines. Just think of the saving in work-in-process inventory as you

eliminate several banks of parts ahead of all those machines.

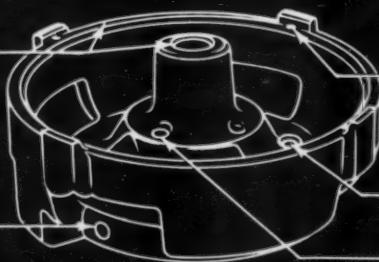
You get other savings with a Kingsbury. Important savings from low maintenance. Less downtime. Low scrap loss. Fewer repair parts. And, of course, lower labor costs. That's because of good basic design and rugged accurate construction. Kingsbury machines run year after year, through millions of cycles, without giving you trouble.

If you need high production at low cost, ask us to give you a specific proposal. Even if your operations are less complex than Whirlpool's, we may be able to help because we build simple machines, too. Kingsbury Machine Tool Corporation, Keene, New Hampshire.

# KINGSBURY

CAST IRON  
FRONT HEAD  
FOR  
REFRIGERATION  
UNIT  
COMPRESSOR

Four Vertical Units  
ROUGH BORE — TWO STEPS  
COMB. SEMI-FINISH BORE  
FORM 45° CHAMFERS  
CHAMFER STEM & FACE  
FINISH BORE  
Four Horizontal Units  
DRILL — 3 STEPS  
REAM

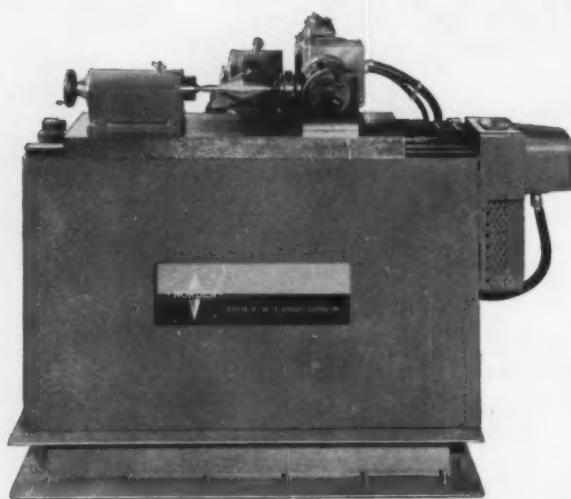


Four Vertical Units with 22 Spindles  
DRILL FOR C'BORE  
TAP DRILL THRU  
TAP THRU  
C'BORE — 4 HOLES  
DRILL  
C'BORE — 2 STEPS  
DRILL — 2 STEPS



## NORDEN • Modumatic Systems for Numerical Inspection

For automatic measurement of actual dimensions or deviations from nominal



Composite view of inspection machine and electronics

Norden's new concept in numerical control applies absolute digital techniques to a wide variety of inspection problems. The Norden system gives digital position information of actual part dimensions as well as deviations from nominal.

### NORDEN SYSTEM

#### INPUT

**Automatic Tape Control**—Standard 1"-8 channel paper or Mylar tape

**Manual Numeric Control**—by ten position rotary switches—one switch per digit in decimal form

**Manual Jog Control**—of position servo motors by push buttons on control panel

#### OUTPUT

**Visual Decimal Display**—continuous display of absolute position, part dimensions or deviations in any axis

**Printout**—typewriter variable format

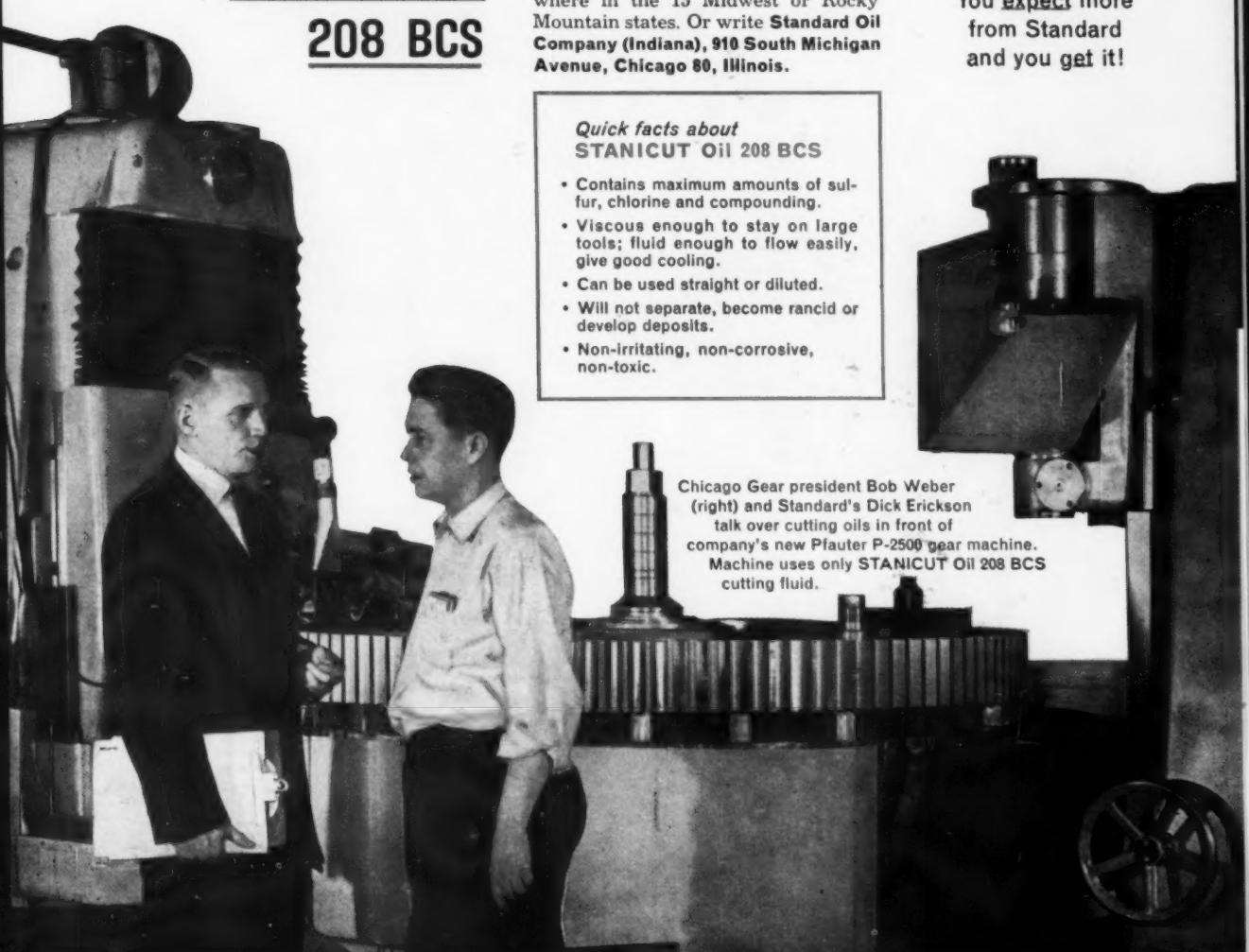
**Punched Tape**

Output can also be designed to meet specific requirements.

The modumatic inspection system also features full range origin selection for fast and accurate part set-up. The entire system is constructed from modules so that you may select the exact features required for your application.

For more information about Modumatic Inspection Systems or other Norden numerical control systems, contact your nearest representative—400 Main Street, East Hartford, Connecticut, JACKson 8-4811-11 West Monument Ave., Dayton 2, Ohio, BAldwin 8-4481, or write us at the address below.

★ **NORDEN** ★ DIVISION OF UNITED AIRCRAFT CORPORATION  
DATA SYSTEMS DEPARTMENT  
3501 HARBOR BOULEVARD, COSTA MESA, CALIFORNIA



# Chicago Gear Mfg. Company tames tough steels, cuts costs with **STANICUT Oil** **208 BCS**

**Tames tough steels.** Gears from one to 300 inches in diameter are machined by Chicago Gear. Steels up to 375 Brinell hardness are worked. STANICUT Oil 208 BCS helps them do it. STANICUT 208 contains maximum amounts of sulfur, chlorine and compounding for handling tough alloy steels. It is viscous enough to stay on tools and work, yet fluid enough for good cooling.

**Cuts costs.** STANICUT Oil 208 BCS is used at Chicago Gear for all gear hobbing operations and applications requiring a straight cutting fluid. There's no chance of the wrong fluid being used, thus no costly losses. One fluid cuts down inventory, saves time in keeping track of stocks, cuts paper work and ordering.

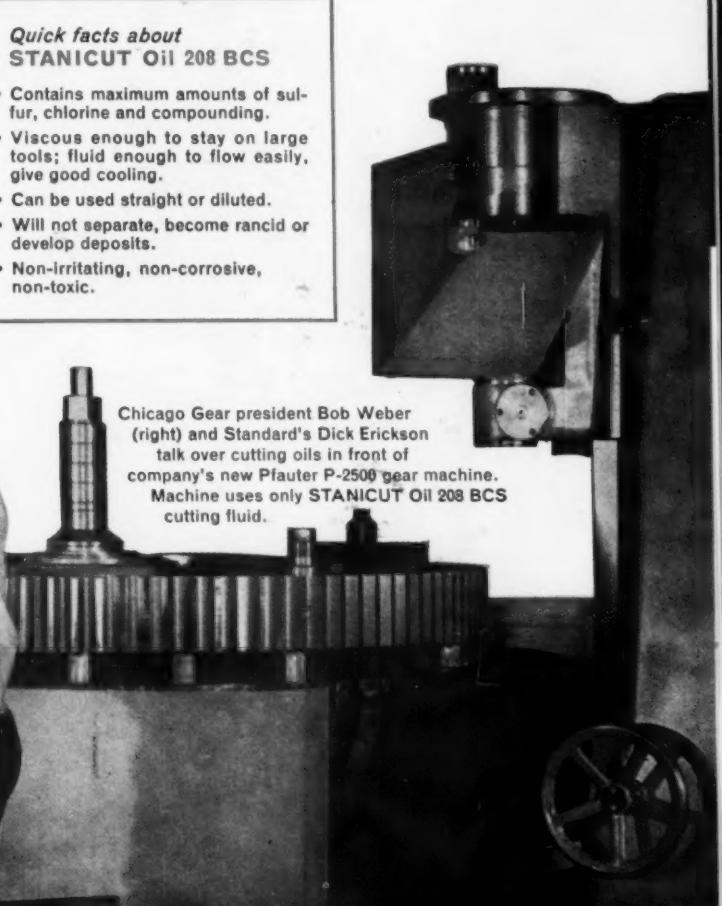
**Gets service.** Standard Oil's Dick Erickson is assigned to the Chicago Gear account. With a mechanical engineering degree from Purdue, plus several years' lubrication experience, Dick knows how to help a customer, knows how to supply technical help where it counts. Could STANICUT Oil 208 BCS and Standard Oil technical service help you? Ask about them at the Standard Oil office near you anywhere in the 15 Midwest or Rocky Mountain states. Or write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.



You **expect** more  
from Standard  
and you get it!

#### *Quick facts about STANICUT Oil 208 BCS*

- Contains maximum amounts of sulfur, chlorine and compounding.
- Viscous enough to stay on large tools; fluid enough to flow easily, give good cooling.
- Can be used straight or diluted.
- Will not separate, become rancid or develop deposits.
- Non-irritating, non-corrosive, non-toxic.



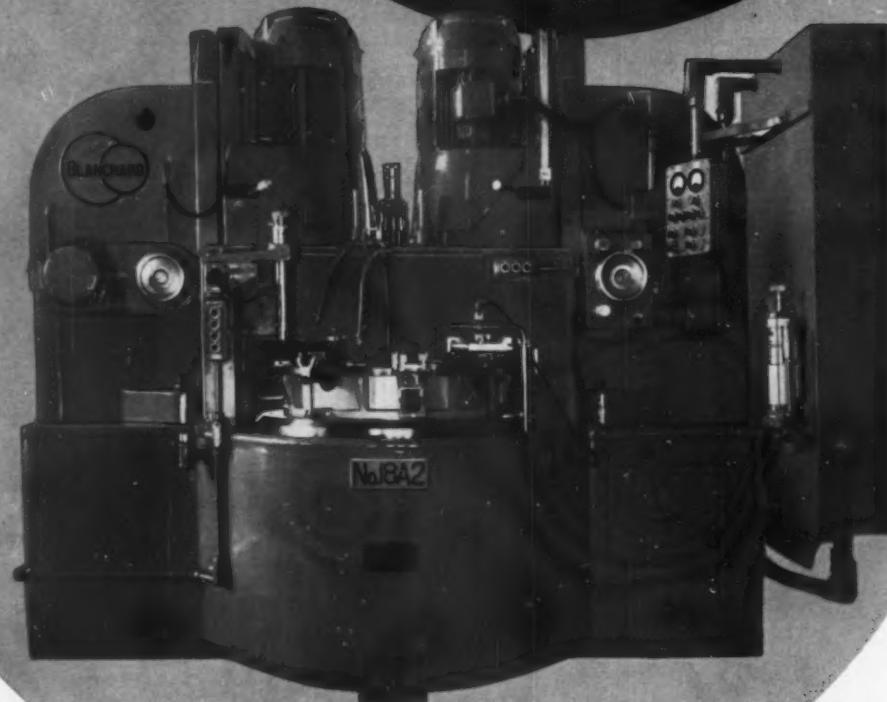
Chicago Gear president Bob Weber (right) and Standard's Dick Erickson talk over cutting oils in front of company's new Pfauter P-2500 gear machine. Machine uses only STANICUT Oil 208 BCS cutting fluid.

# NEW

The No. 18-A2  
Blanchard Surface Grinder  
... a modern Two-Spindle Automatic  
that is accurate, fast and versatile!

This new Blanchard Grinder of advanced design offers you many important features, all adding up to better, faster surface grinding. The No. 18-A2 Blanchard is a versatile, rugged, hard-working machine. It is of a "dry base" design: in operation, all coolant and chips flow to an outside settling tank, separator, or central coolant system. Easy access is provided to the grinding wheel area, and push-button stations and operator's control are conveniently located for ease of set-up. All controls are interlocked, guaranteeing complete safety. Whenever grinding wheels require replacement, a warning light flashes at the operator's station. The No. 18-A2 Blanchard may be equipped with 30, 40 or 50 HP, foot-type spindle motors. This grinder can also be provided with 40" magnetic chuck or 43" plain table for special work holding fixtures.

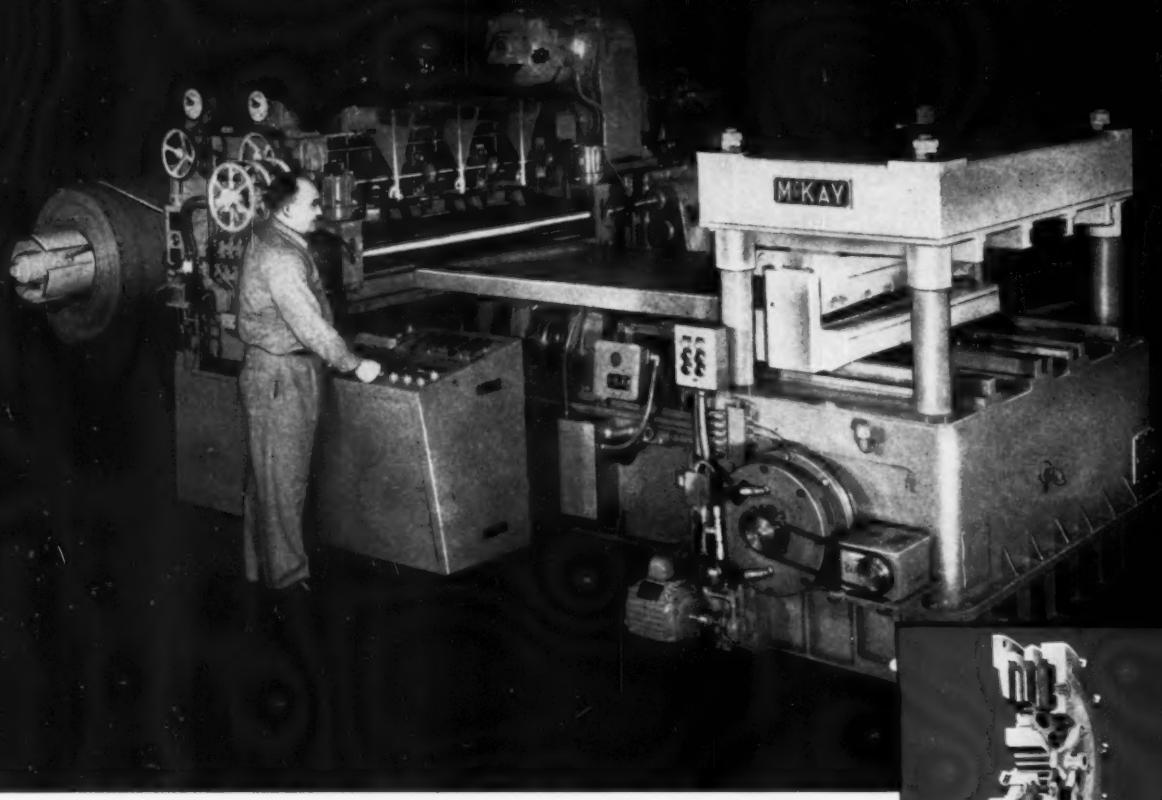
THE BLANCHARD MACHINE COMPANY  
64 State Street, Cambridge 39, Mass., U.S.A.



V-562

## MCKAY SELECTS WICHITA CLUTCH AND BRAKE FOR

### NEW, AUTOMATIC, HIGH-PRODUCTION DIE SHEAR



**Trouble-free, positive-acting Wichita equipment helps  
cutoff press respond instantly and dependably**

The McKaymatic Die Shear Line, in use in warehouses and fabricating plants throughout the world, handles coiled metal in most widths and thicknesses at a top speed of 180 fpm. Especially important in the Line's efficient operation is the Wichita Clutch and Brake on the four column cutoff press. McKay Machine selected Wichita equipment for this severe duty cycle press

because it can guarantee one stroke action with a positive stop at the top of the press stroke, and because of the equipment's quick response.

For all types of precision, heavy-duty assignments you can depend on Wichita Clutches and Brakes . . . call on a Wichita Engineer to help you solve your particular drive problem.

#### Contact your nearest Wichita Engineer.

Clutch & Control Engineering Co., Livonia, Mich.  
Fremont & Lewis, Inc., Cincinnati, Ohio  
W. G. Kerr Company, Pittsburgh, Pa.  
Smith-Keser & Co., Avon, Conn.  
Philadelphia 44, Pa., and New York, N. Y.  
Frank W. Yarline Co., Chicago, Illinois  
Larry W. McDowell, Long Beach, California  
Andrew T. Lobel, Denver, Colorado  
Robert R. King Co., Cleveland, Ohio  
Norman Williams, Houston, Texas

Allied Transmission Equipment Co.,  
Kansas City 8, Missouri  
Donald E. Harman, Dallas, Texas  
C. Arthur Weaver, Richmond, Virginia  
Malcolm S. Cone, Memphis, Tennessee  
Dominion Power Press Equipment, Ltd.,  
Burlington, Ontario, Canada  
R. E. Kunz, Seattle 4, Wash.  
Norman Rupp Co., Portland 4, Ore.  
Bates Sales Co., St. Louis 1, Mo.

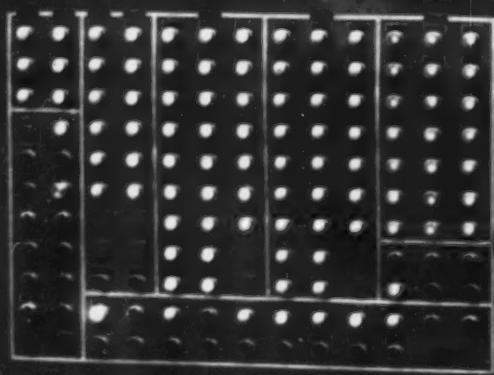


Wichita Low Inertia  
Air-Take Disc Clutch

**WICHITA**  
Clutch  
COMPANY, INC.  
WICHITA FALLS, TEXAS, U.S.A.

NATCO  
HOLEWAY

NATCO  
HOLEWAY



NATCO

Machining sequence is straight line, controlled from a single station, with pallet return conveyor.

## Compact Machining for Compact Cars

Quality, quantity, and convenience in minimum space mark this Natco Holeway, built for machining steering knuckles for one of tomorrow's compact cars. It's a pallet-type machine, and once right and left hand knuckles are clamped in the pallet, there's no rehandling through 48 separate machining operations (plus many probing, cleaning, and orienting operations).

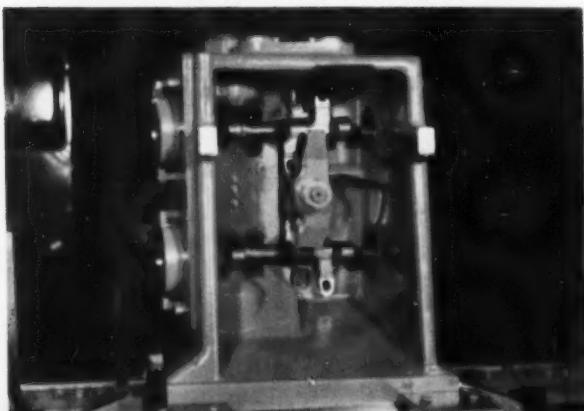
Building block construction accommodates 18 separate stations in one tight package, and will save tremendously in lead time and rebuilding costs when it comes time for model changeover. The machining operations include drilling, tapping, deburring, taper reaming, face milling, chamfering, straight reaming, threading, and keyway milling. Production rate? 100 parts an hour.

Whether you manufacture parts for compact cars or trucks, Natco has a way to machine them better. Call your Natco representative for facts.

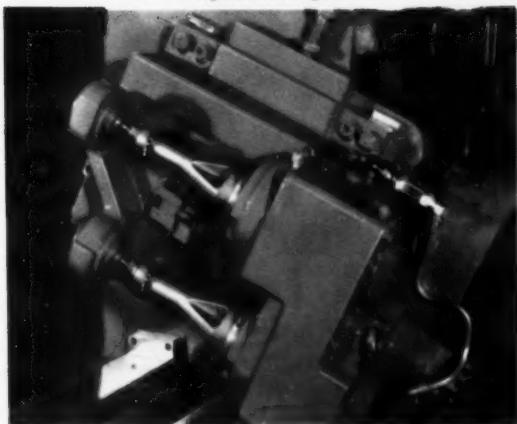


The National Automatic Tool Company, Inc., Richmond, Indiana

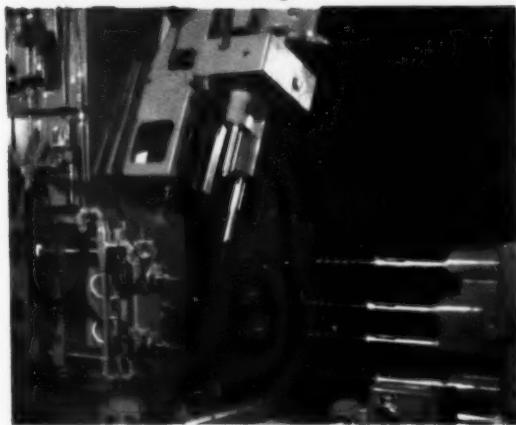
Pallet holds right and left-hand steering knuckles.



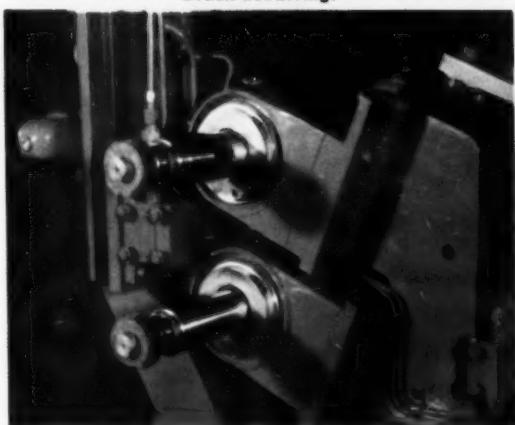
Keyslot milling.



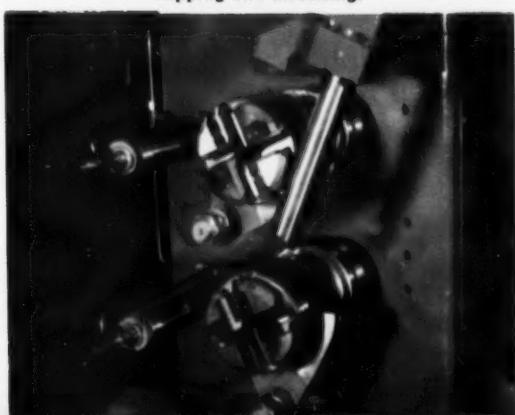
Drilling.



Brush deburring.



Tapping and threading.

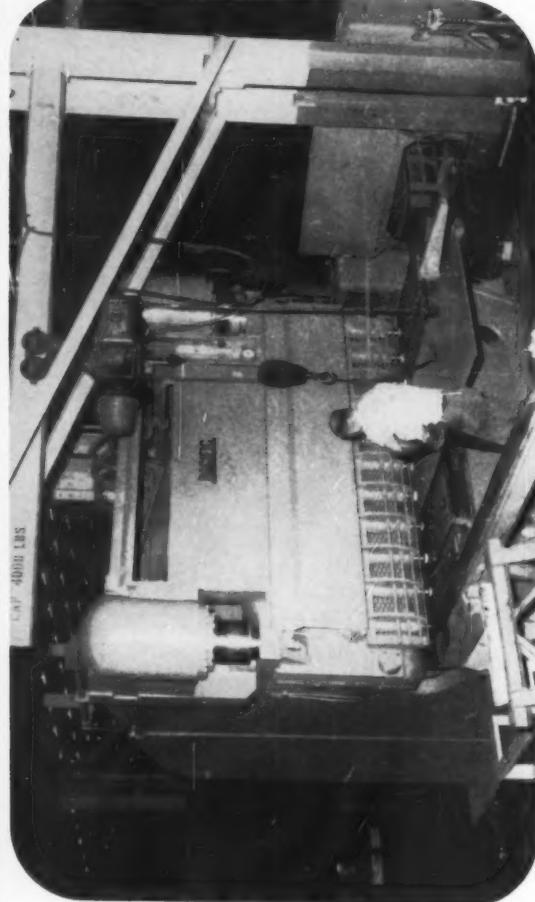


## CUT CONTROL

# PACIFIC ENABLES PACIFIC HYDRAULIC SHEAR TO DO JOBS IMPOSSIBLE ON ANY OTHER SHEAR!

**PACIFIC Cut Control** is a group of adjustments permitting all controls to be set at the optimum value for perfect shearing of each different job: light gauge, heavy plate, polished stainless, soft aluminum, brittle alloys, long narrow strips, high speed cycling for high production, extreme accuracy for precision work. Unlike conventional shears limited in shearing ability by permanent settings without possible adjustment, PACIFIC can be controlled to fit the job exactly. No longer is it necessary to compromise with quality because the shear cannot be adjusted.

- **Adjustable holdowns** eliminate marking of soft polished sheets.
- **Holdowns move down independently of knife** to insure exact alignment of plate before cutting.
- **Adjustable knife clearance** for light gauge shearing with heavy plate shear. Eliminates rough secondary shear fracture in heavy shearing.
- **Rake angle adjustment** for minimum twist or bow in cutting narrow strips.
- **Cushioned shearing plus rake angle adjustment** enable brittle alloys to be cut.
- **Depth of stroke readily adjustable** for slitting.
- **Adjustable cycling speed** so machine speed can be set to match operator's ability to feed plate.
- **Non-wedging back gauge** lift to prevent wedging of narrow strips being cut.
- **Rapid, precision powered back gauges.**



Heavy duty shear for continuous mill type

Safe—the only shear that can be stopped instantly in emergency and is protected against overload

3 to 8 times longer knife life than mechanical shears

Noiseless operation—quieter than a sewing machine

Insignificant maintenance—all moving parts run in filtered oil and are protected against overload

Hundreds of dollars saved in foundation cost

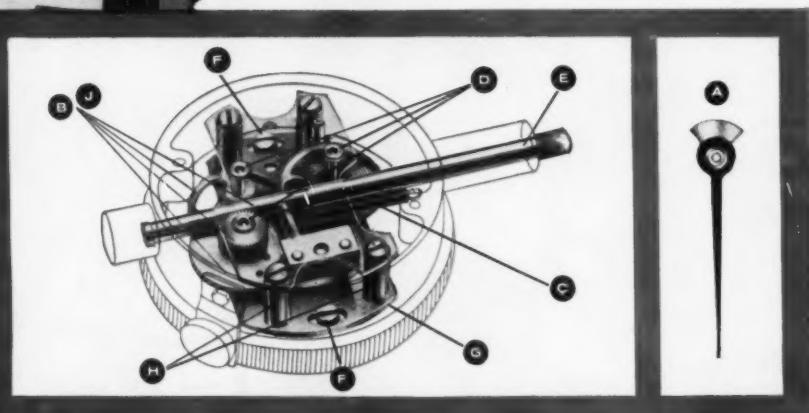
## PACIFIC PRESSES AND SHEARS

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You get all these  
**Plus Features**  
 only in  
**Federal Indicators**

Full Jeweled Bearings, Unit Construction, Low Inertia Indicating Hand, Miracle Movement — each of these advancements pioneered by Federal has a particular significance to you in terms of better performance. AND, with all these *plus* features, Federal Dial Indicators generally sell for LESS due to their wide acceptance which has made possible the economies of quantity production. Here are the features and reasons why they are important:



- A **Functionally designed Indicating Hand** balanced for low inertia, provides greater sensitivity and better repeat accuracy. Hand has highest strength-to-mass ratio to preserve position and shape under heavy gaging action.
- B **Precision-made, Stainless Steel Gears, Rack and Pinion**, for a rustproof, smoother running, more accurate movement.
- C **Positive Contact** with minimum pressure for faithful indicator response.
- D **Full Jeweled Bearings** reduce friction, for improved accuracy over a longer period of time.
- E **Precision Fit** of spindle and bearing for better repeat accuracy.
- F **Accurate Movement Positioning** for optimum rack and gear alignment. Provides extremely close and positive control over a critical fit in *every* indicator.
- G **Unit Construction** for easy maintenance and adjustment.
- H **Rigid Assembly** of top and bottom plates for accurate gear alignment essential to minimum wear.
- J **Gear and Rack Teeth** are hobbed with micro precision so that each Federal Indicator provides uniformly high accuracy throughout its *full* range.

For complete story on Miracle Movement, write . . .

FEDERAL PRODUCTS CORPORATION • 61112 Eddy Street • Providence 1, R. I.



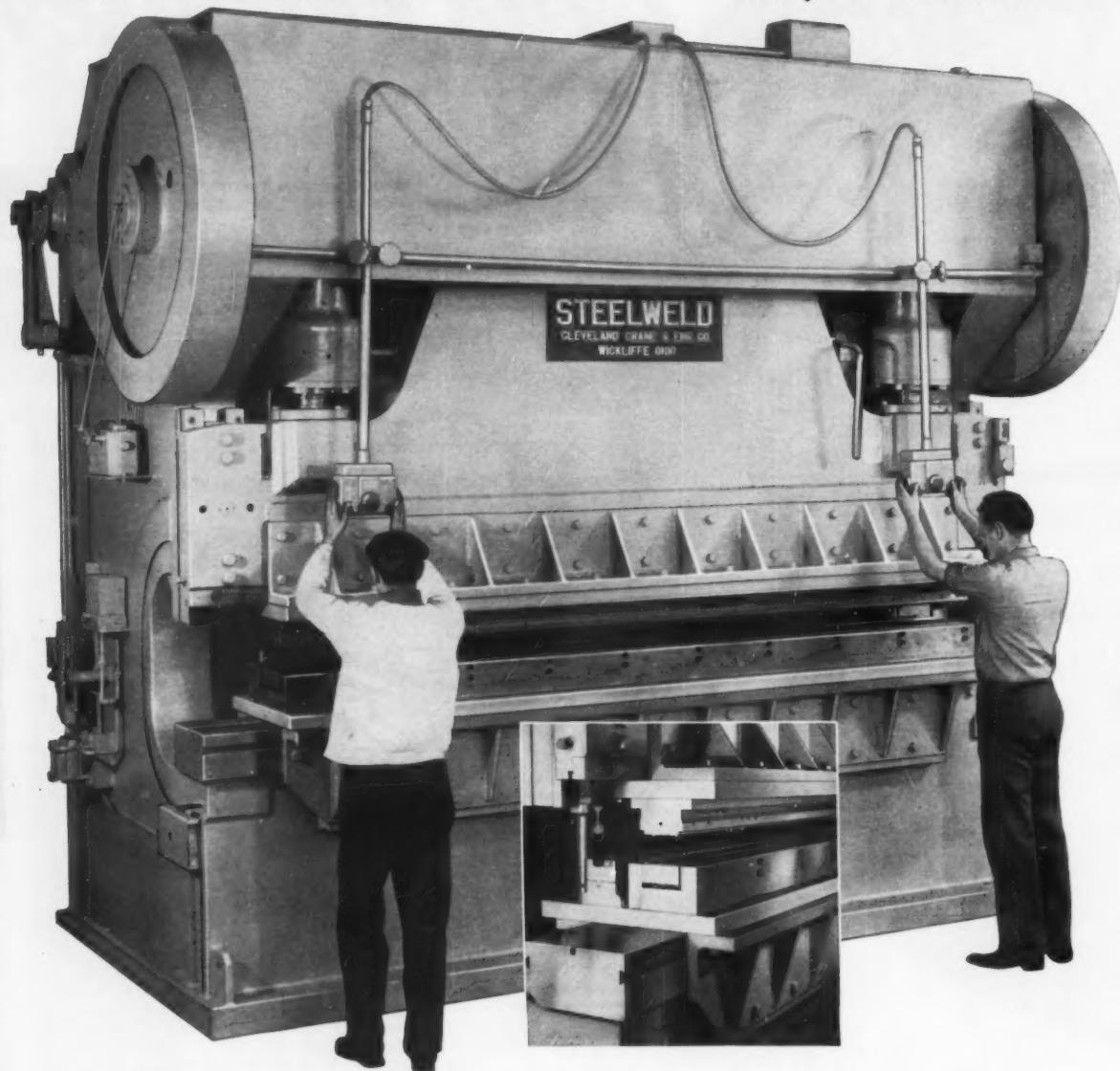
Ask **FEDERAL** First

for recommendations in modern gages . . .

Dial Indicating • Air • Electric, or Electronic — for inspecting, measuring, sorting, or automation Gaging

# STEELWELD PRESS BRAKE CUTS FORMING COSTS

Fast Two-Step Operation Speeds  
Trolley Duct Production



ELECTRIC trolley duct is turned out at a high rate on a Model K5-10 Steelweld Brake. The machine is fitted with removable bed and ram brackets to provide the width necessary to support two sets of dies. The front dies flange both sides of steel strips. The rear dies form the flanged strips into ducts. Thus, with each stroke of the ram, two operations are performed and a trolley duct completed. As many as 20 ducts can be produced per minute, which is the speed of the machine.

Two men normally work at the press, and each is provided with a set of control buttons. As a safety measure, two "run" buttons

requiring both hands of the two men, must be depressed to operate the machine.

This machine has air-electric control which eliminates the need of any cross shafting at front for mechanical foot treads. Air-electric control makes push-button operation possible and provides fast, positive clutch and brake action.

Write for free copy of catalog No. 2023A

## STEELWELD

Mechanical and Hydraulic

### PRESS BRAKES

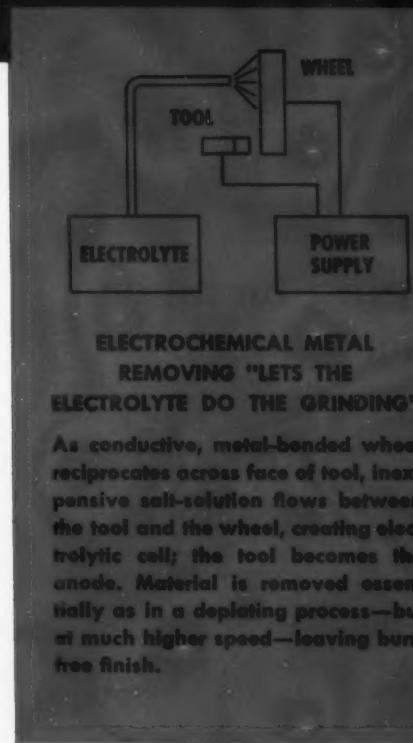
Steelweld Machinery includes: Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.



STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 5472 E. 281 ST. • WICKLIFFE, OHIO

# NEW Reciprocating Electrolytic Tool Grinder

**MICRO-FINISHES  
CARBIDES, CUTS  
DIAMOND-WHEEL  
WEAR 80%**



As conductive, metal-bonded wheel reciprocates across face of tool, inexpensive salt-solution flows between the tool and the wheel, creating electrolytic cell; the tool becomes the anode. Material is removed essentially as in a deplating process—but at much higher speed—leaving burn-free finish.



59-25

Because its reciprocating wheel just "wipes away" the carbide particles, Ex-Cell-O's Style 264 Electrolytic Tool Grinder reduces diamond wheel consumption by as much as 80 per cent! With one set-up, tools can be precision-finished to better than 15 micro-inches—free from heat checks, cracks or burns caused by abrasive contact.

The Style 264 grinds the cutting edges of carbides and other super-hard tool materials at one end, grinds chip breakers at the other. Wheel stroke is fully adjustable. Standard equipment includes: Ex-Cell-O Precision Spindle with inbuilt reversible motor, universal chip breaker fixture (shown in circled inset, above), and pressure system for electrolyte.

Write direct, or see your Ex-Cell-O Representative for details on the Style 264, conventional Style 142 Reciprocating Tool Grinder, and others in the complete Ex-Cell-O line.

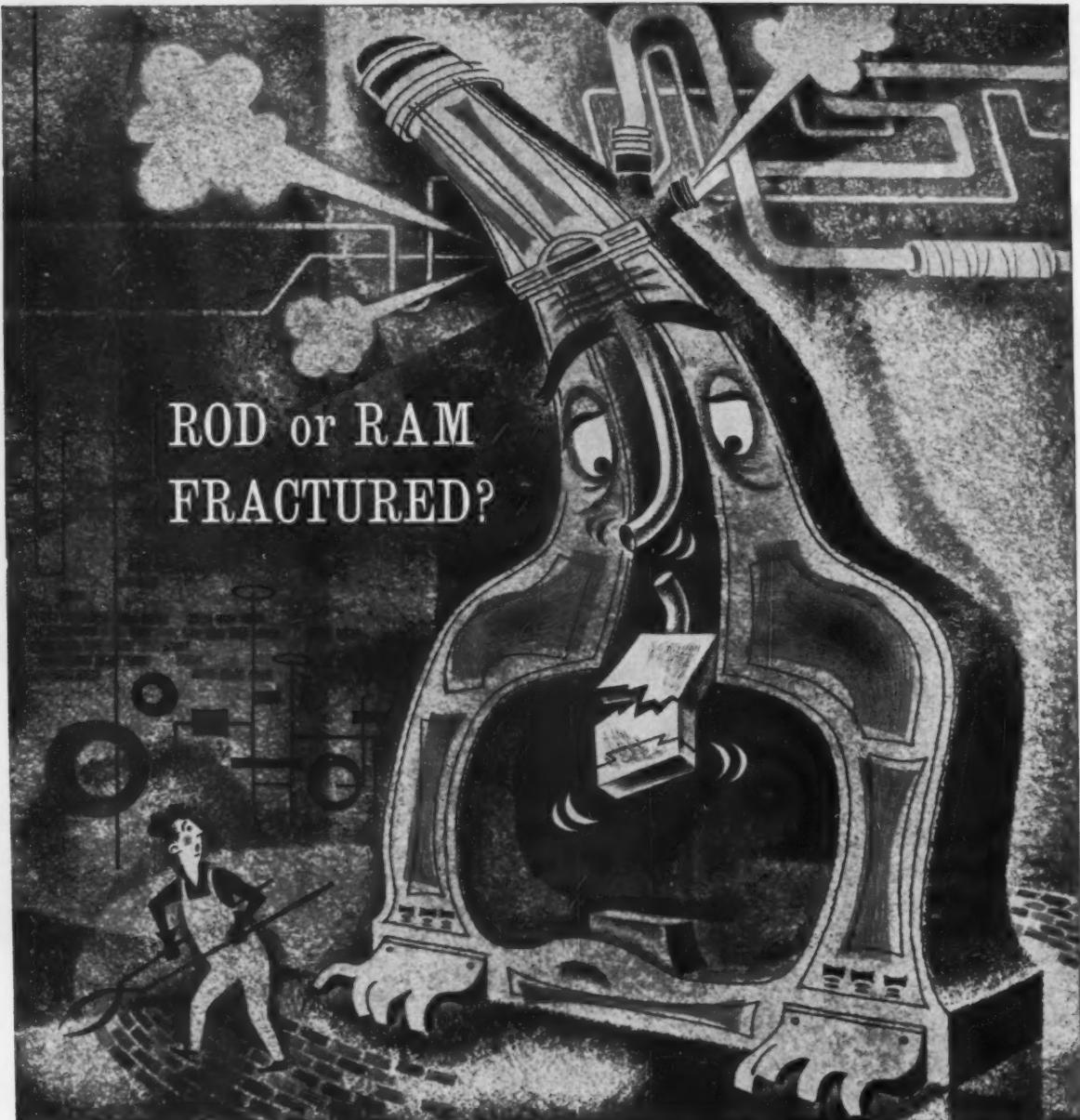
**EX-CELL-O**  
CORPORATION  
DETROIT 32, MICHIGAN

**XLO**

EX-CELL-O FOR PRECISION

Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



## ROD or RAM FRACTURED?

Call ERIE FOUNDRY for forging hammer  
replacement parts to your specifications

Replacement rods and rams, and many other parts for a wide variety of forging hammers of most any make are available from Erie Foundry. They are high in quality, competitive in price.

For over 65 years Erie Foundry has specialized in the design, development and manufacture of forging hammers of all types. Logically, then, Erie Foundry is a sure source for repair parts equal in quality and performance to the original equipment. Substantial inventories assure you of prompt service.

For more information on repair parts or our complete Rebuilding Service, write Mr. James Walker.

*Manufacturers of Forging Hammers • Forging Presses • Hydraulic Presses • Trimming Presses*

EF-50-01

**ERIE**

ONE OF THE GREAT NAMES  
IN FORGING SINCE 1895

ERIE FOUNDRY CO., Erie, Pa.

# POSITIONING BREAKTHROUGH!

## BENDIX ANNOUNCES Numerical Control System for point-to-point work

Long a leader in the numerical contouring field, Bendix has acquired exclusive U. S. sales and service rights on the Ferranti FP-22 numerical POSITIONING control system for machine tools.

The FP-22 is truly the practical answer to the positioning requirements of jig borers, drilling machines, punch presses and other point-to-point applications. Because its measuring equipment is independent of the machine's drives, economical installation is assured—without the necessity of ultra-precision lead screws and gear boxes.

Another example of Bendix PACKAGED PRODUCTIVITY—accurate, dependable, automatic tape control for competitive efficiency.



99.9999

*Position display numbers shown here are actual size.*

### Outstanding features of the Ferranti FP-22 include:

- Floating zero**—quick and easy set-up—low cost tooling.
- Dial input**—provides manual operation flexibility.
- Continuous position display**—available as an option.
- "Accumulator" power supply**—eliminates line voltage fluctuations.
- Fully transistorized**—requires less warm-up time—less power—less maintenance.
- No contacting parts in measuring units**—no wear—no eventual loss of accuracy.

*Backed by complete service and customer training programs.  
For additional information, contact your  
machine tool distributor or Bendix.*

### Industrial Controls Section

21820 Wyoming, Detroit 37, Michigan





## *Here's a Team of Mills that Really Pay their Way*

When you can use South Bend Milling Machines for tool and die work and fill in free time with production runs, you've got an ideal situation. Here Metal Processors are drawing upon the two main capabilities of these machines—accuracy for exacting work and productivity for manufacturing operations.

"Double lives" are not unusual for South Bend Mills as they are readily adaptable to wide varieties of work with a minimum of effort and no sacrifice in accuracy because

of such features as these:

- Head rotates 360° vertically . . . mills, bores, drills and reams at any angle
- Keyed ram saves re-setting, holds alignment
- 30 table feeds; infinitely variable quill feeds
- 32" or 42" tables, 20" or 30" table travel, 20" spindle to table, 20" spindle to column

Prices start at \$1829 less power feeds.

**WRITE FOR COMPLETE INFORMATION**

### ***SOUTH BEND LATHE***

SOUTH BEND LATHE, INC.  
SOUTH BEND 22, IND.

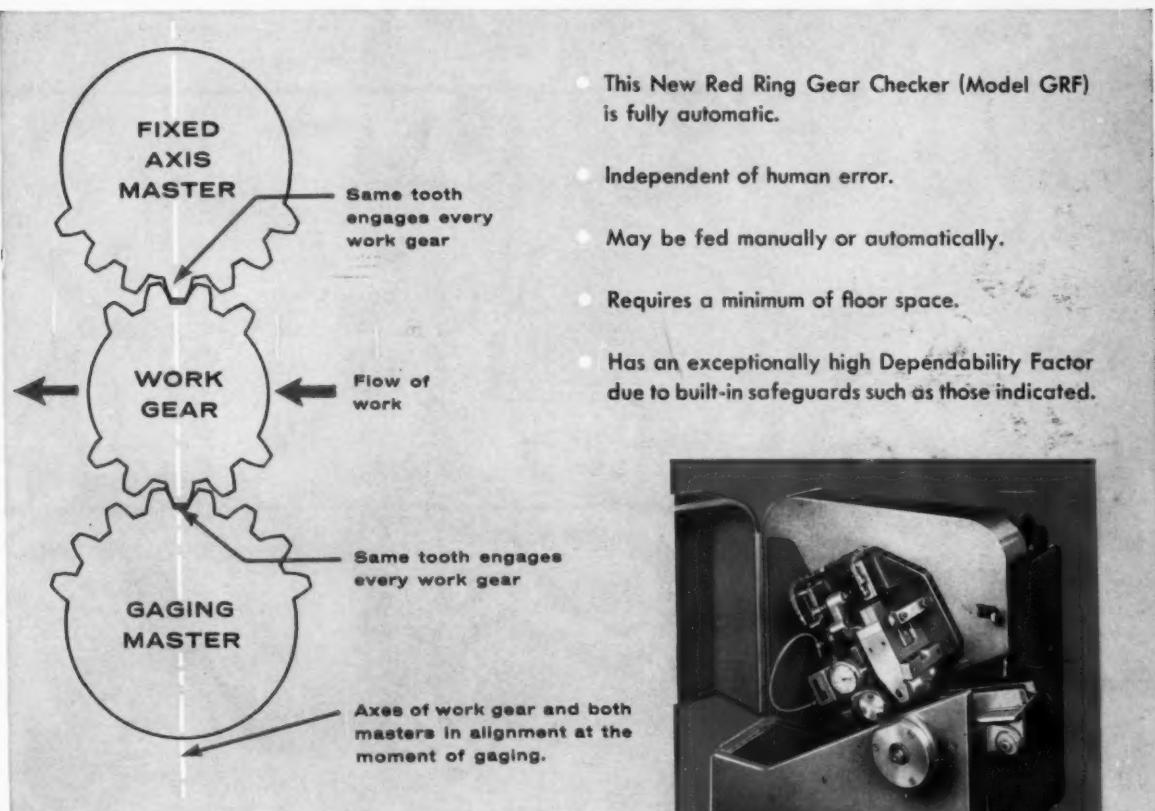
*Builders of Lathes • Milling Machines • Shapers • Drill Presses • Pedestal Grinders*



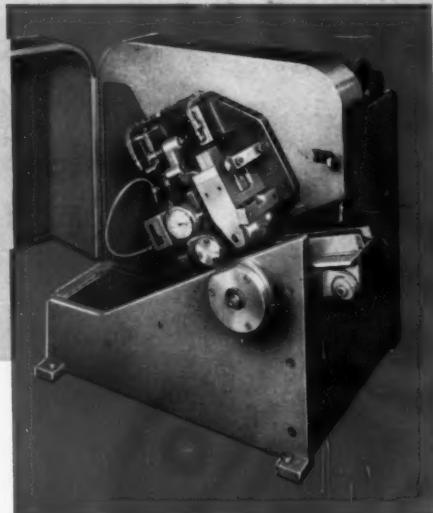
# CUT INSPECTION COSTS



## Check pin-size of 1,000 gears per hour



- This New Red Ring Gear Checker (Model GRF) is fully automatic.
- Independent of human error.
- May be fed manually or automatically.
- Requires a minimum of floor space.
- Has an exceptionally high Dependability Factor due to built-in safeguards such as those indicated.



If you mass-produce pinions ask for Bulletin C60-8



SPUR AND HELICAL GEAR SPECIALISTS  
ORIGINATORS OF ROTARY SHAVING,  
GEAR HONING AND ELLIPTOID

**NATIONAL BROACH & MACHINE CO.**

5600 ST. JEAN • DETROIT 13, MICHIGAN

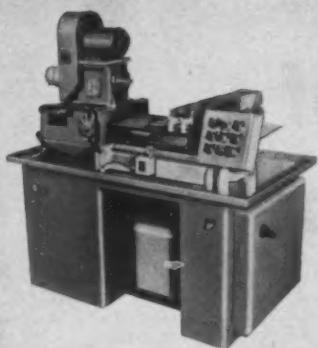
WORLD'S LARGEST PRODUCER OF GEAR SHAVING AND HONING EQUIPMENT

MACHINERY, December, 1960

For more data circle this page number on card at back of book

# JONES & LAMSON'S NEW PRECISION LINE of smaller machines

precision performers  
in the under \$10,000  
price range.

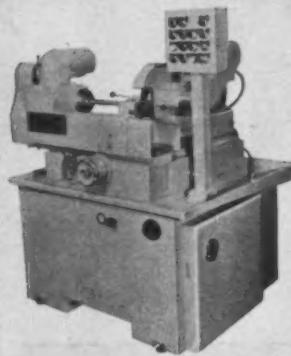


## MODEL 6 PRECISION BORING MACHINE

FEATURES: • choice of three automatic cycles  
• push button operation  
• varied chucking for rotating either tools or work  
• applicable for multiple spindles

SPECS: *write for folder #6016*

Swing — 10" dia. max., Stroke — 7½" max.  
Bore — .090" dia. min., 3" dia. max.

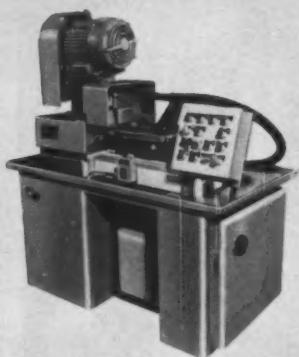


## MODEL 410 PRECISION THREAD GRINDER

FEATURES: • stark simplicity in set up and operation — push button control  
• pre-packed work and wheel spindles — lubricated for life  
• dual lead compensation (short & long)  
• all machine slides are on pre-loaded rollers for smooth accurate traverse

SPECS: *write for folder #6015*

Work Dia. — 4" max., Thread Length — 10" max.  
Wheel Speeds — 2700 RPM



## MODEL 6D PRECISION GUN DRILLING MACHINE

FEATURES: • high penetration rates (12" per min. not unusual)  
• automatic cycling — push button control  
• spindle distributes 12-15 gals. of coolant per min. at 2,000 PSI  
• infinitely variable and constant feed rate

SPECS: *write for folder #6014*

Spindle Speeds — 15,000 RPM, Max. Length of hole — 6",  
Dia. of hole — ½" max., .074 min., Stroke — 7¾" max.

# JONES & LAMSON

Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vt., U. S. A.

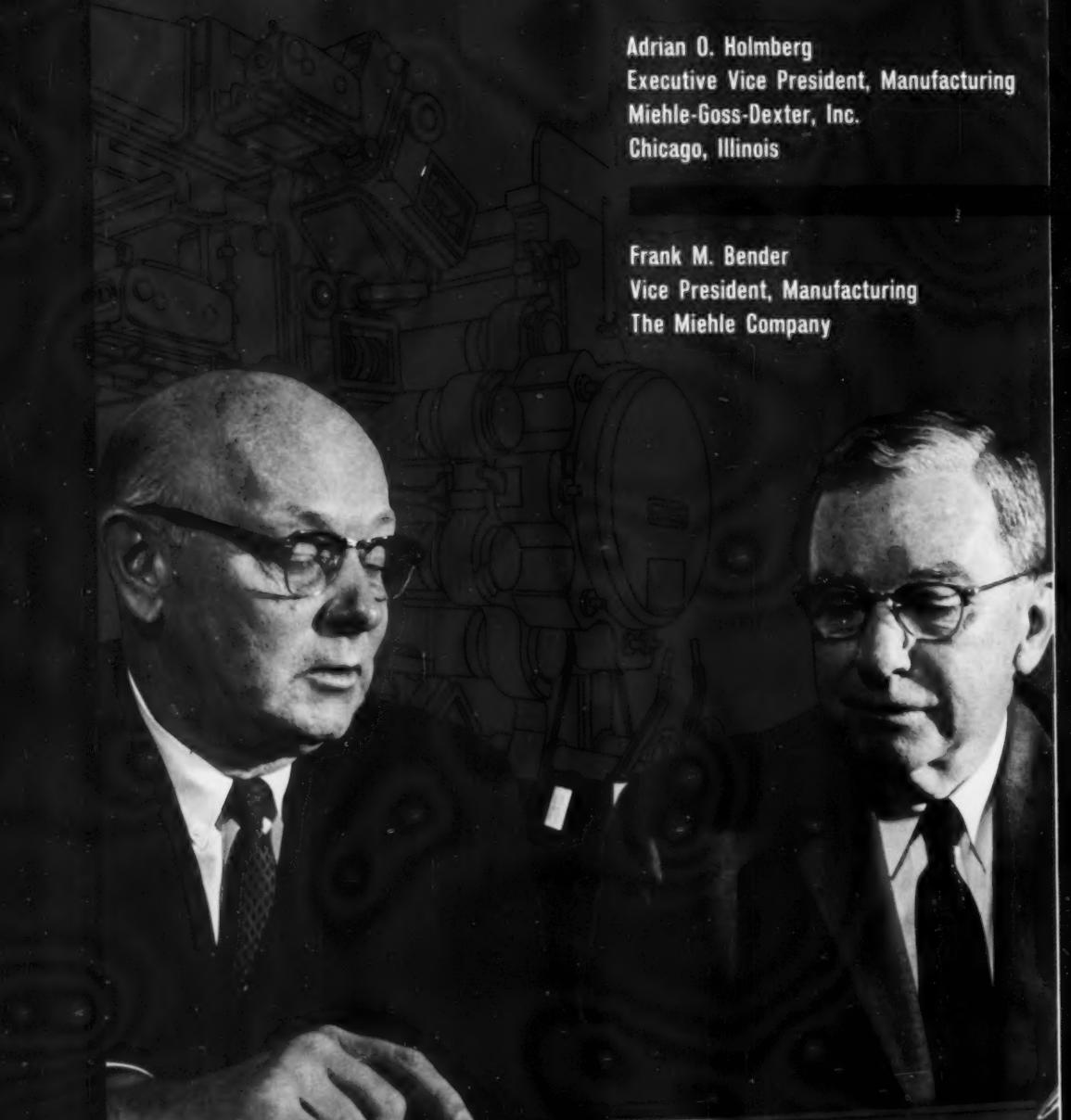


THREAD TOOL

DIVISION

# "WE'RE USING TAPE-CONTROLLED MACHINE TOOLS

...TO ACHIEVE GREATER PRODUCTION WITH A MINIMUM  
OF EQUIPMENT SO WE CAN DELIVER BETTER PRODUCTS  
TO THE GRAPHIC ARTS INDUSTRY AT COMPETITIVE PRICES"



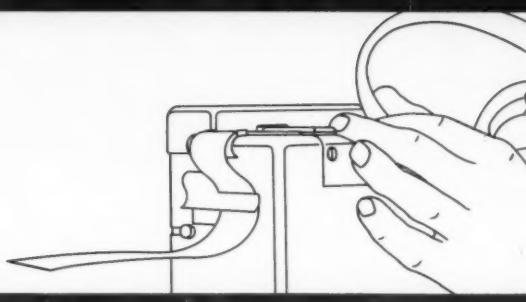
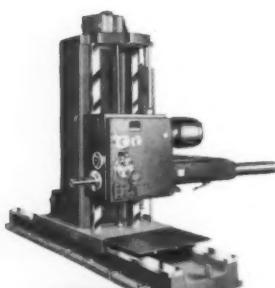
Adrian O. Holmberg  
Executive Vice President, Manufacturing  
Miehle-Goss-Dexter, Inc.  
Chicago, Illinois

Frank M. Bender  
Vice President, Manufacturing  
The Miehle Company

## Route Slip

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

◀ For routing  
tear out  
on  
perforation.



## HOW GIDDINGS & LEWIS TAPE CONTROLS ON SHORT RUNS AT MIEHLE-GOSS-DEXTER

### ... AN INTERVIEW WITH THE MEN WHO TOOK THE COMBINATION OUT OF THE PLATE

### AND SAVED AS HIGH AS \$130,000 IN TOOLING FOR JUST ONE PART

Everybody's talking about tape control and inevitably more and more companies are getting into it. But the lag time between talk and do is penalizing many plants in profits annually.

Miehle-Goss-Dexter, Inc., Chicago, world's largest manufacturer of aircraft and industrial tape-controlled machine tools, has gone further into tape-controlled machining than all but a few companies outside the aircraft industry. Their experiences in all phases of tape-controlled machining, from justification before purchase to the operating and maintenance knowledge, are a guidebook to other manufacturers who are "looking" at tape.

The highlights are told here through an exclusive interview with **John C. Goss**, Executive Vice President, Manufacturing, Miehle-Goss-Dexter, Inc., and **John C. Goss**, Manufacturing personnel of two divisions, The Miehle Company and The Goss Company.

**Question.** What is the principal effect of numerically controlled machine tools on your manufacturing?

**Answer.** Numerical control of machine tools has been a real break-through in counteracting continuously rising costs.

In the five years since we bought our first tape-controlled machine, we have made tremendous strides in cost reduction, and the values are becoming more evident every day.

**Q.** You say you bought your first tape-controlled machine five years ago. How many do you have in operation now?

**A.** We bought a positioning table first. Now we are operating 19 numerically controlled machines throughout our three divisions. We have five Giddings & Lewis horizontal boring, drilling, and milling machines, including your new 6" model. Incidentally, we believe that a good place to start in tape is with a horizontal machine, both to gain experience and realize immediate large savings.

**Q.** What prompted you to go into tape?

**A.** There were a lot of factors. We wanted to do the same or more work with fewer machine tools, to eliminate many jigs and fixtures, and to gain manufacturing floor space.

We operate what are really large job shops — an average run of a part seldom exceeds 50

pieces. Miehle-Goss-Dexter is in the graphic arts industry, and we have a lot of work specially designed to be done in small quantities, and this sometimes means a lot of jigs.

We sought to eliminate the time and cost involved in designing and manufacturing new jigs and fixtures.

### 750 Fixtures

**Q.** Have you realized the savings you anticipated?

**A.** Yes, indeed. We have reduced the number of fixtures in our shop from 750 fixtures to 150 fixtures, and we have fewer setups per part. We have improved accuracies.

There are big savings in tooling costs. For example, a design change on a new part can be made in a few minutes. It takes from less than 10 minutes to 40 man-hours to produce a new fixture "tool" with tape — depending on the number of operations to be performed.

We have a direct comparison between the cost of manually controlled fixtures and numerically controlled fixtures. Before we bought our first Giddings & Lewis at Miehle, we spent \$100,000 in tooling to produce a fixture for a part. We have since tooling for almost the same part, and we can machine it on the new machine for only about \$20.



## CONTROL PAYS -DEXTER, INC.

### COMPANY INTO "TAPE" ST ONE NEW PRODUCT

and more will go into it.  
ants thousands of dollars

urer of graphic arts equipment but a few manufacturers of tape, from the economic use know-how, are literally pe.

ow with Adrian Holmberg, er, Inc., and key manufac-  
The Goss Company.

Goss-Dexter provides the industry with many presses and to customer specifications, this means one-of-a-kind parts.

eliminate the tremendous costs of designing, manufacturing, and jigs and fixtures.

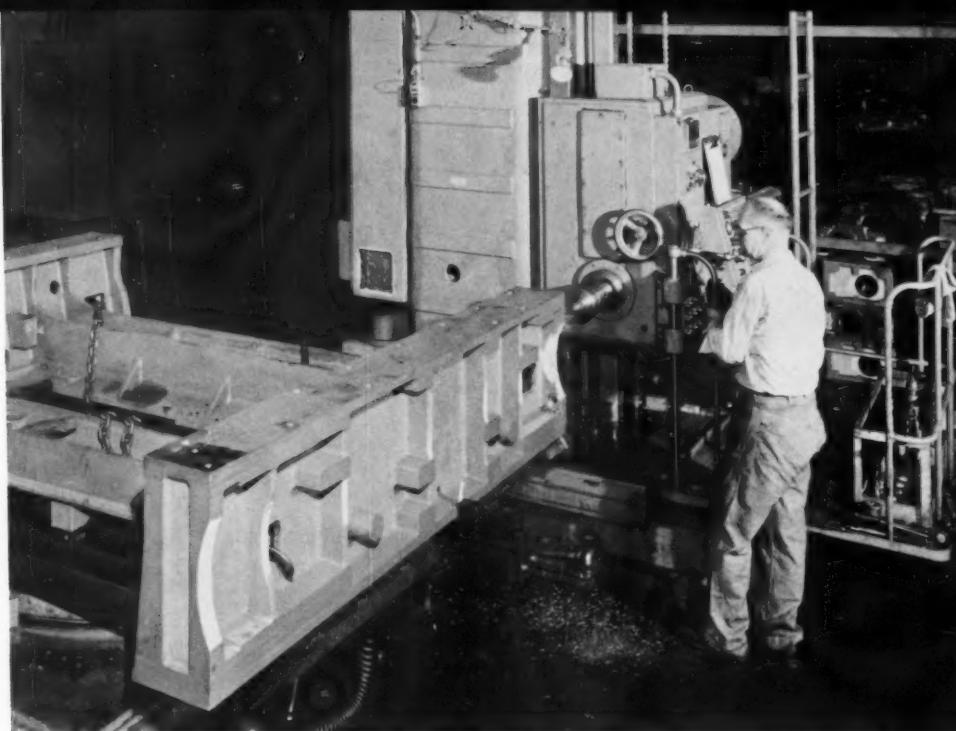
#### Fixtures Junked

alized the savings and ben-  
ited?

. We have junked more than our various divisions. We also less per piece and less material have saved floor space and cies.

avings whenever we get a part a new model machine to build. as than one man-hour to, say, to process a manuscript and — dependent upon the num- to be performed on the part.

et comparison on tooling costs controlled versus tape-controlled we bought the Giddings & we spent close to \$150,000 for a certain product. Later almost an identical product to the Giddings & Lewis for a about \$20,000.



**Q.** On this tooling question, you eliminate jigs for positioning the tool, but what about workholding fixtures?

**A.** For the most part, we completely eliminate these, too. Because Industrial Engineering and Manufacturing study and establish the location of the part on the table, we often are able to use standard angle plates and locating stops as holding fixtures.

On some of the G&L's we use your air-lift rotary tables so only one setup is required.

#### Faster, Lower Cost Assembly

**Q.** Any other advantages of numerical control?

**A.** Accuracy and true duplication of parts. This insures quality of product and brings costsavings on the assembly floor. Everything lines up now. Assembly goes faster and easier.

Additionally, we eliminate other types of machine tools. For example, on certain parts we formerly did important holes on the jig borer — then sent the work to the layout bench. Even then we had fitting problems. Now we do this work with G&L machines and make truly interchangeable parts.

**Q.** How accurate are your machines?

**A.** Our G&L machines consistently provide  $\pm .001$ " repeatability on hole center dimensions. This accuracy has eliminated many checking operations and gages.

#### Tape Preparation

**Q.** Will you explain briefly the programming and preparation of the punched paper tapes?

**A.** These procedures are quite easily learned. It is important though that various departments become oriented and think in terms of tape-controlled machining.

First, it is desirable to have the Engineering Department put co-ordinate dimensions on their drawings for any operations to be performed under tape control.

Working from this type of dimensioning the Industrial Engineering Department uses standard forms to show workpiece location on the machine table, spindle location, speed, feed, type of tool, depth of feed, and explanation.

A fast, accurate typist transfers the industrial engineer's data to a master operations sheet in duplicate, using a typewriter which simultaneously punches a master tape and an auxiliary machine code tape.

The master tapes and sheets are filed.

**Q.** What type of personnel are best qualified to handle programming for tape operation?

**A.** Those who know something about shop practice. No special personnel are required.

Industrial engineers are well qualified. In one plant we have a man from Methods who formerly did checking on tool drawings. Another was formerly a plant layout man. Still



Russell L. Hogin, machine tool co-ordinator, The Goss Company, Division of Miehle-Goss-Dexter, Inc.

Walter G. Schalk, man-  
ufacturing engineer, The  
Miehle Company, Division  
of Miehle-Goss-  
Dexter, Inc.





Russell L. Hogen compares \$12,111.48 in jigs "traded" for \$513.20 worth of tapes! This is a typical saving made with a G&L Numeripoint-controlled machine by The Goss Company in machining the first of each of 17 new printing press parts.



another of our programmers had but six months' experience in our shops, yet mastered the job within a month and a half.

**Q. About how many tapes have you made?**

**A.** We have made and are using more than 12,000 different punched paper tapes in our plants. You can see that we have a lot of parts being produced under numerical control. Here is where a little paper work really pays off.

**Q. Do you make one-of-a-kind parts under tape control?**

**A.** Whether you make a tape depends upon the number of machining operations to be performed on a part, as well as upon the number of parts. Often we make a tape for only one part, particularly where high accuracy is required, or if we expect that we may ever be required to make a duplicate.

Of course, with the digital dial control on your Model 3045 horizontal, we can manually dial in the spindle position with the same accuracies as with tape. We frequently use this control for making one-of-a-kind parts or for very small runs where only a few holes are to be located on each surface. But if as many as six or eight holes are to be located on a surface, we find it is better to make a tape.

**Q. Whom do you use for numerical-control system maintenance?**

**A.** This presents no problem. Our regular electricians can handle it. The systems are

becoming increasingly reliable. In a recent three-month period, we had 2,053 hours' running time out of a possible 2,223 for two machines, and that includes downtime for both machine and control maintenance.

**Economic Justification**

**Q. What are the possible savings on your Giddings & Lewis machines?**

**A.** We are saving anywhere from 10% to 40% over our previous methods, which were those commonly used today throughout the metalworking field.

We especially like the Giddings & Lewis machines because of their ease of operation and handy controls. You don't have to fight the job all day long. The floor-type machine also is very good for us because it gives us great flexibility in handling large or small parts.

**Q. Would you care now to summarize the benefits of tape-controlled machining?**

**A.** There are a number, as we have discussed. You get true interchangeability of parts. No hand rework on the assembly floor. Responsibility for accuracy control is put in the hands of the engineers. Chance for operator error is almost entirely eliminated. Many checking operations are eliminated.

Tooling costs are greatly reduced. Floor-to-floor time is reduced as much as 30 to 50%. Over-all manufacturing costs are lower.

We get big savings on prototypes — the first of a new type of machine. These sometimes call for modifications later — easy to make with tape.

Fewer machine tools are required to do the same amount of work. Savings in floor space are significant.

Last, but not least, there is less operator fatigue and less chance for errors. The operator observes predetermined specified operations of the machine instead of performing all the positioning and other work required with manually operated equipment.

Tape control really is management control of production. All in all, we don't see how any plant with short runs can afford not to use numerically controlled machine tools.

**If you've been thinking about tape, there's no time like the present to discuss it with Giddings & Lewis — the people who built the first commercial tape-controlled machine tool and who have shipped more major machines with numerical control than any other manufacturer. Consult your local G&L distributor or write.**

# GIDDINGS & LEWIS

GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wis., Est. 1859

Jig borers and milling machines; horizontal boring, drilling, and milling machines; vertical turret lathes; vertical boring mills; positioning tables; die sinking machines; contour milling machines; radial and upright drilling machines; planers; planer mills; numerical and tracer control systems; Davis boring tools.

THE  
**TIMKEN**  
ROLLER BEARING  
COMPANY

THE  
**TIMKEN**  
ROLLER BEARING  
COMPANY

CANTON 6, OHIO, U.S.A.  
TELEPHONE: GLENDALE 2-1311  
CABLE ADDRESS: "TINPROCO"

June 3, 1960

Mr. C. R. Stroupe  
Vice President  
ANOCUT ENGINEERING COMPANY  
631 W. Washington Boulevard  
Chicago 6, Illinois

Dear Mr. Stroupe:

We are pleased to report that the Timken Roller Bearing Company now has a total of nine Anocut units in operation in the Canton, Columbus, and Bucyrus Divisions.

Seven of these are 300 and two are 600 ampere units. The seven 300 ampere units are used on 6" x 18" Norton Surface Grinders for chip breaker grinding operations. Three of these units are in a dual setup whereby a switch kit is used to switch the Anocut unit to a Porter-McLeod Cut-Off Machine. These cut-off machines are used to salvage chipped tools and cut carbide to special lengths.

The two 600 ampere units are used on Hammond SCE-10 dual table oscillating grinders. On these latter machines, we are, for example, removing  $\frac{1}{2}$ " square,  $\frac{1}{4}$ " solid carbide in 45 sec. from a tool approximately  $\frac{1}{2}$ " square, processing two tools simultaneously.

We are realizing a savings of 7 to 1 in diamond tool costs, and a reduction in grinding time of approximately 4 to 1.

*C. A. Laase*  
C. A. Laase

Mechanical Engineering Department

# REPORTS SAVINGS...

**7 TO 1** REDUCTION IN...  
DIAMOND WHEEL COSTS

**4 TO 1** REDUCTION IN...  
GRINDING TIME

## WITH **ANOCUT** ELECTROLYTIC GRINDING



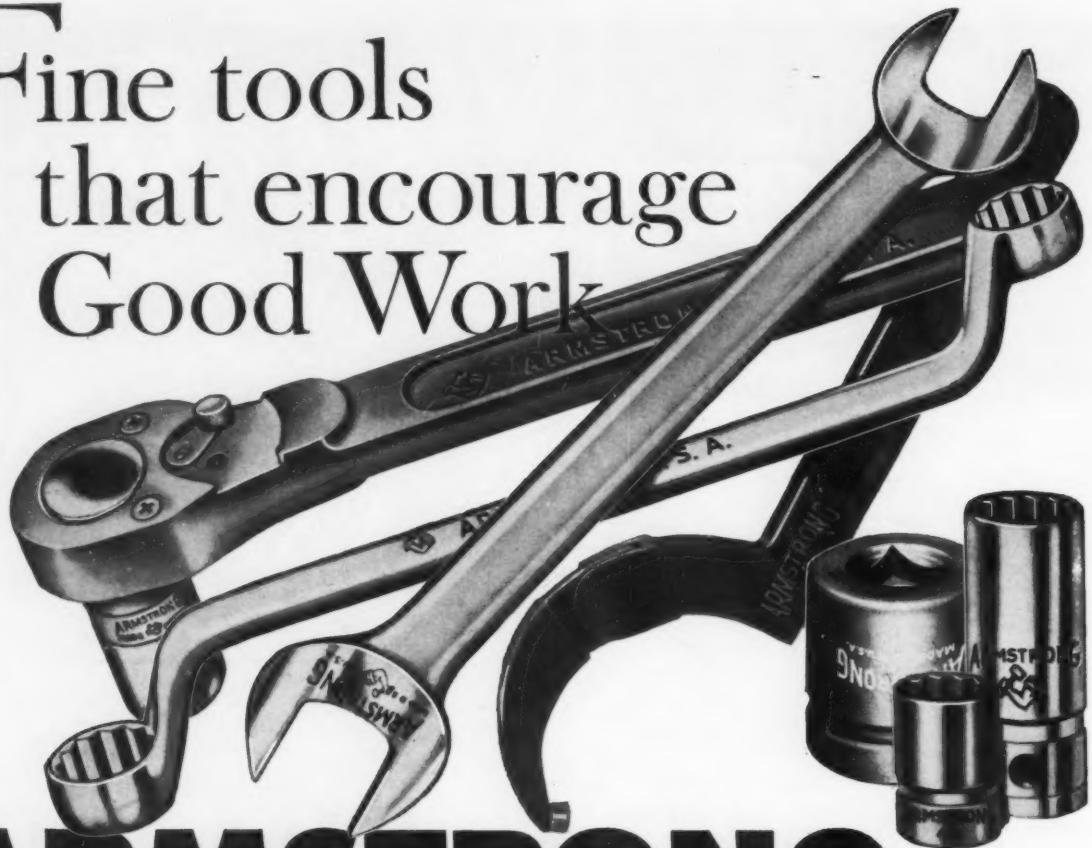
OFF-HAND GRINDING SINGLE POINT TOOLS ON  
HAMMOND 10" DUPLEX ELECTROLYTIC GRINDER.



ELECTROLYTIC CHIPBREAKER GRINDING ON NORTON SURFACE GRINDER.

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Fine tools  
that encourage  
Good Work



# ARMSTRONG WRENCHES

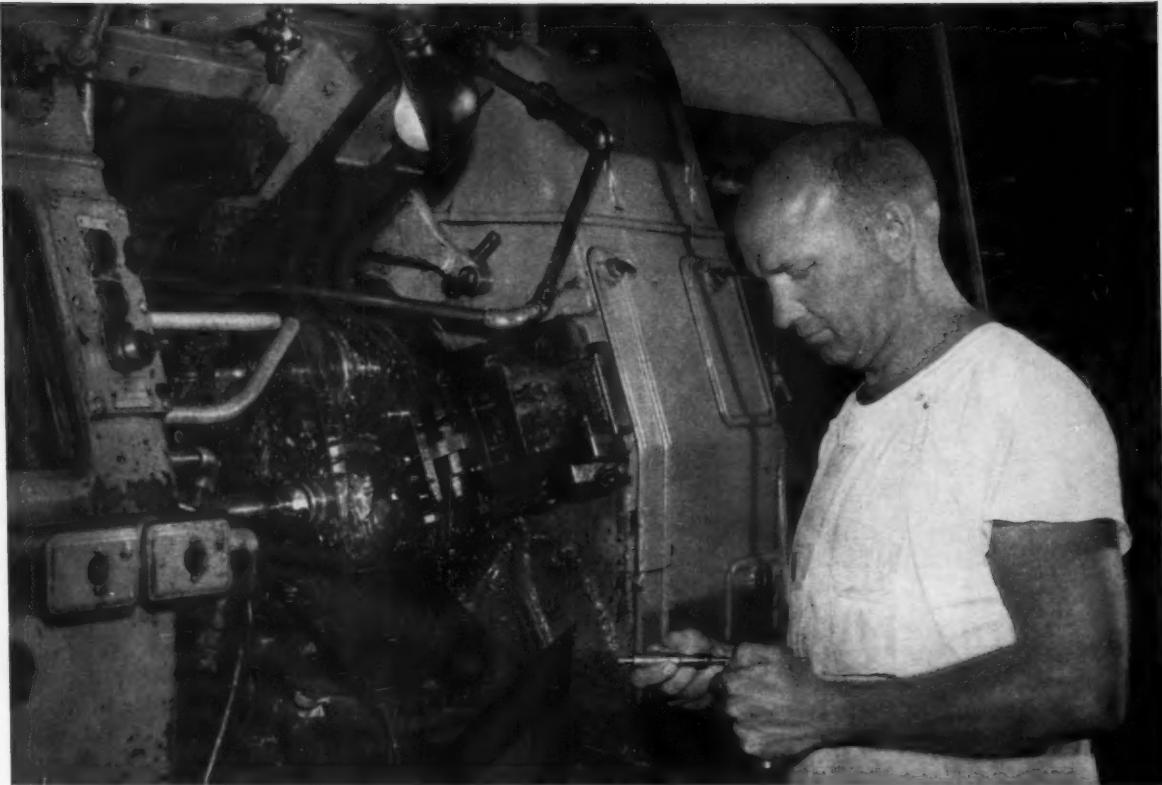


If you don't know your local  
ARMSTRONG Distributor,  
we will send you the names  
of those in your area.

An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types—single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

**ARMSTRONG BROS. TOOL CO.** 5213 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.





## Manufacturer increases tool life 20% with CLEARTEX

### —saves \$100 monthly on oil alone!

The Master Vibrator Company of Dayton, Ohio—maker of portable heaters, cement finishers and other contractor equipment—was having trouble with lube oil diluting the cutting oil on their automatic screw machines. There were too many tool regrinds and too many rejects. A Texaco Metalworking Engineer suggested a test of Cleartex. They agreed to using a 10 gallon sample on one automatic. That was November, 1959.

In one month they were convinced. By using Cleartex on both cutting and lube sides they solved their problem—no more dilution of cutting oil. And look at the results: Tool life increased 20%; actual monthly savings on oil of \$100; less carry-off on chips; cleaner machines; fewer rejects; happier operators and delighted management! No wonder they switched entirely to Cleartex and are now regular users of 10 drums a month!

Why not send for your copy of Texaco's new booklet—"Cleartex in Automatic Screw Machines." This illustrated guide will show you how to end dilution of cutting oil—and the profit-draining costs in rejects and tool life it causes. Just mail the coupon. Or if you want immediate

savings, ask to have a Texaco Metalworking Engineer set up a test in your plant—on one machine, or on your whole line.

Texaco Inc., 135 East 42nd Street, New York 17, N.Y.

Tune In: Texaco Huntley-Brinkley Report, Mon. Through Fri.-NBC-TV



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on the Cleartex Cure.

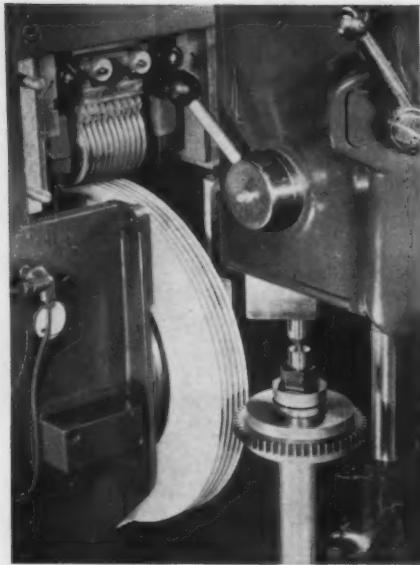
Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_





## and scrap rate cut from 75% to 3%...

At Hughes Aircraft Co., El Segundo, California, a Sheffield Model 140 Gear Grinder produces external precision spur and helical gears of 32 to 96 diametral pitch from hardened or soft, preformed or solid blanks. Floor-to-floor times have been cut so dramatically that we've listed some of the "before" and "after" figures at the right. All of these were for gears ground from solid blanks.

Previous high scrap rate was caused by warping and distortion in heat treatment after hobbing and shaving. Most of the gears—steel, aluminum, and beryllium copper that used to break shaving cutters—are now ground with wheels dressed by the Sheffield Crushtrue® method. The grinder also makes precision class 4 master gears for Hughes, and even on small jobs is twice as fast as former methods.

The 140 Grinder can Crushtrue® or diamond dress wheels, handles D.P.'s from 8 to 200. Write for the full cost-saving Hughes story.

# precision gear floor-to-floor times

## CUT TO THE BONE

### COMPARATIVE FLOOR-TO-FLOOR TIMES (minutes)

D.P.	Prec. Class	Mat'l	No. Teeth	O.D.	Face Width	BEFORE	AFTER
32	2	440C	28	.937	.36"	11.7	5.3
32	2	440C	84	2.687	.36"	24.7	9.8
36	2	440A	13	.437	.643	10.6	5.7
36	2	4340	94	2.667	.480	27.7	15.7
48	2	440A	56	1.328	.312	11.1	7.0
48	2	440A	62	1.500	.125	12.2	6.6
48	2	440C	96	2.042	.250	14.9	9.5
48	2	416SS	20	.458	.125	7.7	4.2
48	1	416SS	78	1.667	.125	13.2	7.6
48	1	4140	105	2.229	.125	15.8	9.2
48	2	416	100	2.500	.090	15.3	8.9
48	1 & 2	303SS	120	2.541	.125	17.2	10.1
54	2	440A	68	1.292	.145	12.6	6.3
60	2	440A	84	1.433	.187	15.3	7.2
60	2	440A	14	.279	.281	7.1	3.7
64	1	BeCu	39	.641	.067	9.1	4.1
64	1	302SS	104	1.652	.100	14.5	6.0
64	2	440C	112	1.781	.125	15.1	6.3
64	2	4130	120	1.895	.187	15.9	6.6
64	2	4140	83	1.328	.250	12.8	5.8
64	2	416 CRES	88	1.406	.050	13.2	5.6
96	2	BeCu	150	1.576	.125	18.4	7.4
96	2	BeCu	90	.951	.110	7.5	5.6

Grinding times given for 2 passes (32 thru 48 D.P.) or one pass (54 D.P. and finer).

The  
**SHEFFIELD**  
Corporation

Dayton 1, Ohio

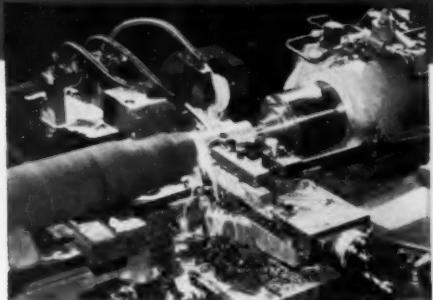
*A subsidiary of The Bendix Corporation*

Inspection Gages, Dimensional Control Instruments, Machine Controls, Automatic Gaging & Assembly Systems, Measuray® X-Ray Thickness Measuring, Crushtrue® & Multiform® Grinders, Cavitron® Ultrasonic Machine Tools, Press-Pacer® Transfer Units, Large Dies, Tooling, Contract Manufacturing.

# Don't Tool Up for Tomorrow's Boom with Yesterday's Lathes



## MONARCH'S HIGH PRODUCTION LATHES OF TOMORROW...



Model 20-H Mona-Matic is available in 18", 30" and 42" center distance. Swing over bed is 15"; over front slide and rear slide ways, 8". Bed ways are flame hardened and ground.

### 4.. The New Model 20-H Mona-Matic—A Low First Cost Production Lathe

Take a good look at what we've done to the Mona-Matic concept of production turning. This new machine

- (1) *Carries a low price tag, because of simplified design*
- (2) *Has fast hydraulic feed and traverse movements, making it exceedingly productive*
- (3) *Is a dependable day after day performer, requiring only routine maintenance for years of trouble-free service*

The Model 20-H is a fully automatic double carriage turning

machine, with a 60° "Air-Gage Tracer" controlled front tool slide. A variety of automatic cycling arrangements provides high productivity and versatility. Eight spindle speeds are available by pick-off gears in each of three standard ranges. The tailstock has an air actuated spindle and inbuilt, heavy duty, anti-friction center.

Front carriage feed rate is infinitely variable from 1" to 40" per minute; traverse is 200" per minute. Rear slide feed rate is  $\frac{1}{2}$ " to 40" per minute while traverse is at 90" per minute.

Four different feeds are available to the carriage. Either a one or a two cut cycle can be furnished. Two cut cycle machines are provided with a selector switch for one or two cut operation.

Imagine better performance at lower cost these days! Why not let us set up a demonstration on your parts? *The Monarch Machine Tool Company, Sidney, Ohio.*

**Monarch**  
TURNING MACHINES

IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER



**Thompson's exclusive  
"CYBERMATIC PENDANT CONTROL" completely eliminates  
the elevating hand wheel**

All vertical movement of the wheel head, both automatic and manual, on this modern Thompson 36 x 48 x 72 Type CX Plunge-Matic Grinder is accomplished effortlessly by dials on the Cybermatic Pendant Control.

This new pendant control performs the following functions: Sets automatic down feed from .0002" to .006" in .0002" increments—sets the total amount of automatic down feed for stock removal from 0 to 1 inch through the entire 48" vertical capacity—controls automatic down feed increment (as pre-selected) at each reversal of the wheel head on cross feed or at each table reversal on straight plunge feed—controls a 20" per minute rapid traverse to the elevation of the wheel head—provides a push button to re-set the down feed range at operator's will—pre-sets a wheel dressing increment for automatic wheel trueing—compensates manually or automatically for wheel dressing—provides a master stop button for all movement.

This Thompson machine is completely modern in every respect. Its features include the exclusive Thompson Hydra-Cool Hydraulic System with dual packless cylinders providing automatic cushioning. A separate automatic

lubrication system for all sliding way bearings and tape bed way covers are standard equipment.

This modern Thompson grinder is both high powered and extremely accurate.

Further specifications will be furnished upon request.

**PRE-LOADED  
SELF-ADJUSTING  
COLD RUNNING  
ROTATIONALLY STABLE  
VIBRATIONLESS  
FREE FROM WEAR**



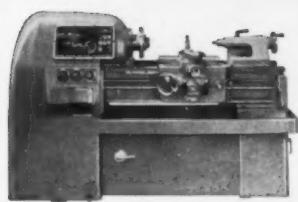
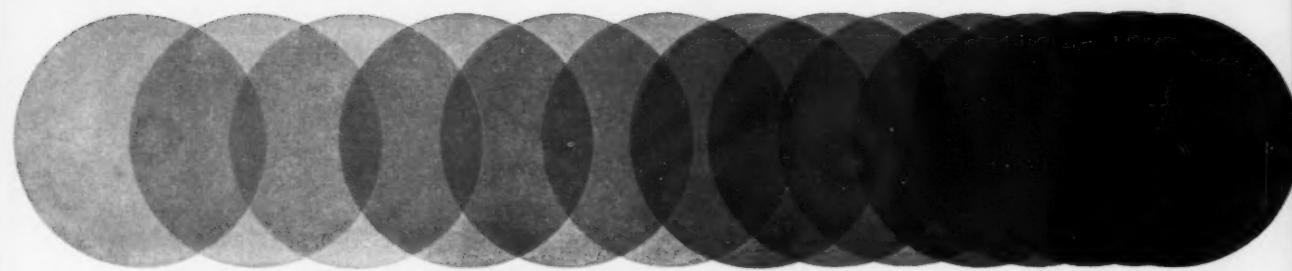
Thompson has taken another important step toward the ultimate in accuracy and precision by obtaining the exclusive use of the world famous MALCUS BLOCK BEARINGS for their wheel head spindles. The notable advantages of these bearings are listed above.



THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO

*"Keep Thompson in mind for that daily grind"*

# Infinitely Variable Spindle Speeds!



new proven design  
**NEBEL**  
**MICRO-TURN\***  
HIGH-SPEED PRECISION LATHE

Here is the ultimate in turning efficiency and convenience. Simply push a button until the spindle speed you desire indicates on the tachometer. A continuously variable range of spindle speeds from 43 to 3500 RPM is provided by a highly efficient, proven mechanical speed variator belt-less type drive unit with full motor horsepower (3 or 5 HP) throughout the entire range and speed constant within .2%. But this is just one of the revolutionary features of the Nebel MICRO-TURN. Write today for your copy of the complete story on the new MICRO-TURN Lathe, described in Bulletin No. 219. Nebel Machine Tool Corporation, Lathe Division, 3410 Central Parkway, Cincinnati 25, Ohio.

# The prettiest tool-maker at Pratt & Whitney



She probably wouldn't know a micrometer from a hairpin, but using that Friden Flexowriter®, she's preparing a numerical control program tape which helps speed production of tools that are faster, more reliable and far more accurate than ever before.

Today, Pratt & Whitney Company is building five different types of numerically controlled machine tools—and using numerically controlled tools to do much of the work!

Significantly, Pratt & Whitney now uses eight-channel

punched paper tape control exclusively. After much experimentation, P&W, like so many others in the field, has chosen punched paper tape as the best all-around input medium. Reliable, dependable, easy-to-program—punched paper tape is fast becoming the one thing that most numerically controlled tools have in common.

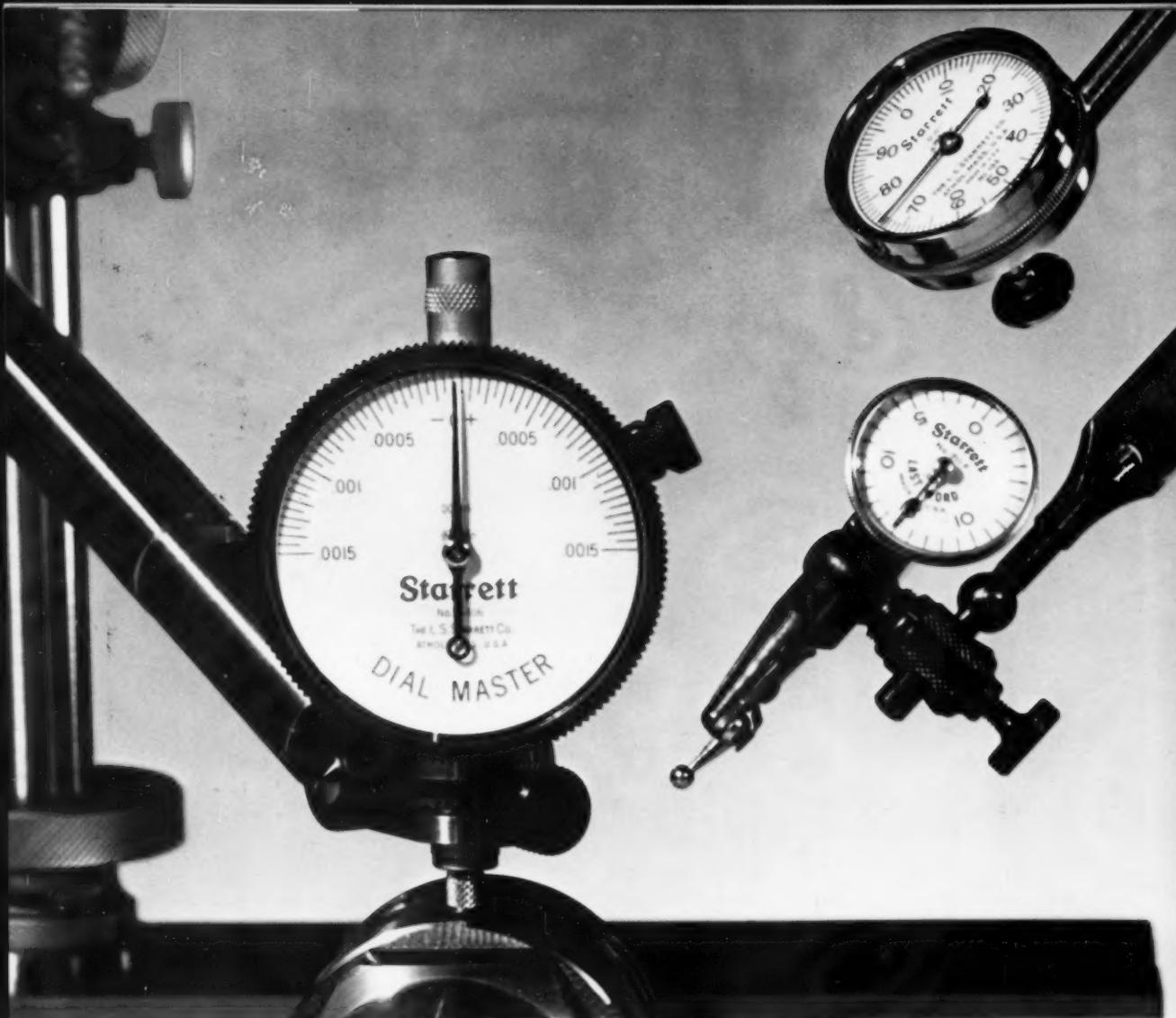
*THIS IS PRACTIMATION: The Friden Model NC-1 Flexowriter is a perfect example of what we call PractiMation—automation so hand-in-hand with practicality there can be no other word for it.*

© 1960 FRIDEN, INC.

FOR FURTHER INFORMATION WRITE TO FRIDEN, INC., SAN LEANDRO, CALIF.  
SALES, SERVICE AND INSTRUCTION THROUGHOUT THE U. S. AND THE WORLD

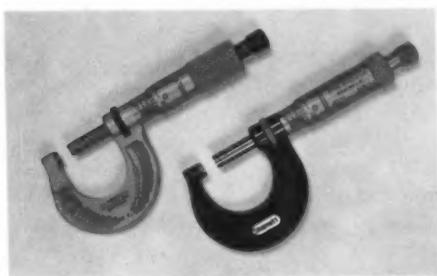


# Friden



DIAL INDICATORS AND GAGES — No. 25-106 DIAL-MASTER Super Precision Dial Indicator, No. 196 Dial Test Indicator and No. 711F LAST WORD Dial Test Indicator.

## new **Starrett**<sup>®</sup> dial-master super precision dial indicator



PRECISION TOOLS

PRECISION GROUND DIE AND FLAT STOCK



HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

Designed to bring laboratory standards to shop inspection and for laboratory work, new Starrett No. 25-106 DIAL-MASTER Super Precision Dial Indicator is graduated to .00005", accurate to  $\pm .00001$ " and reads .0015-0-.0015 with a total range of .003". It is an outstanding addition to the complete line of Starrett Dial Indicators and Dial Gages available through your nearby Industrial Supply Distributor along with the many other highest quality Starrett products. Call him — or write for complete Catalog No. 27. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U.S.A.

*World's Greatest Toolmakers*

# TIMKEN Fine Alloy STEEL



## PACKAGED SAVINGS for tool steel users

Precision ground flats of Graph-Mo® steel are a complete package of savings for makers of gages, dies and other tool steel parts. Here's why.

**THEY COME PRECISION GROUND TO SIZE**, decarb free, ready for marking and cutting. No costly stock removal. And . . .

**GRAPH-MO MACHINES 30% EASIER** than conventional tool steels.

**GRAPH-MO'S HEAT-TREATING RESPONSE** is uniform, eliminates distortion in preparation.

**GRAPH-MO OUTWEARS** ordinary tool steels 3 to 1 because of the free graphite and diamond hard carbides in its structure.

**SPECIAL PROTECTIVE WRAPPING** assures top condition of your Graph-Mo precision ground flats when you're ready to use them.

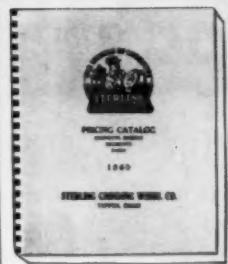
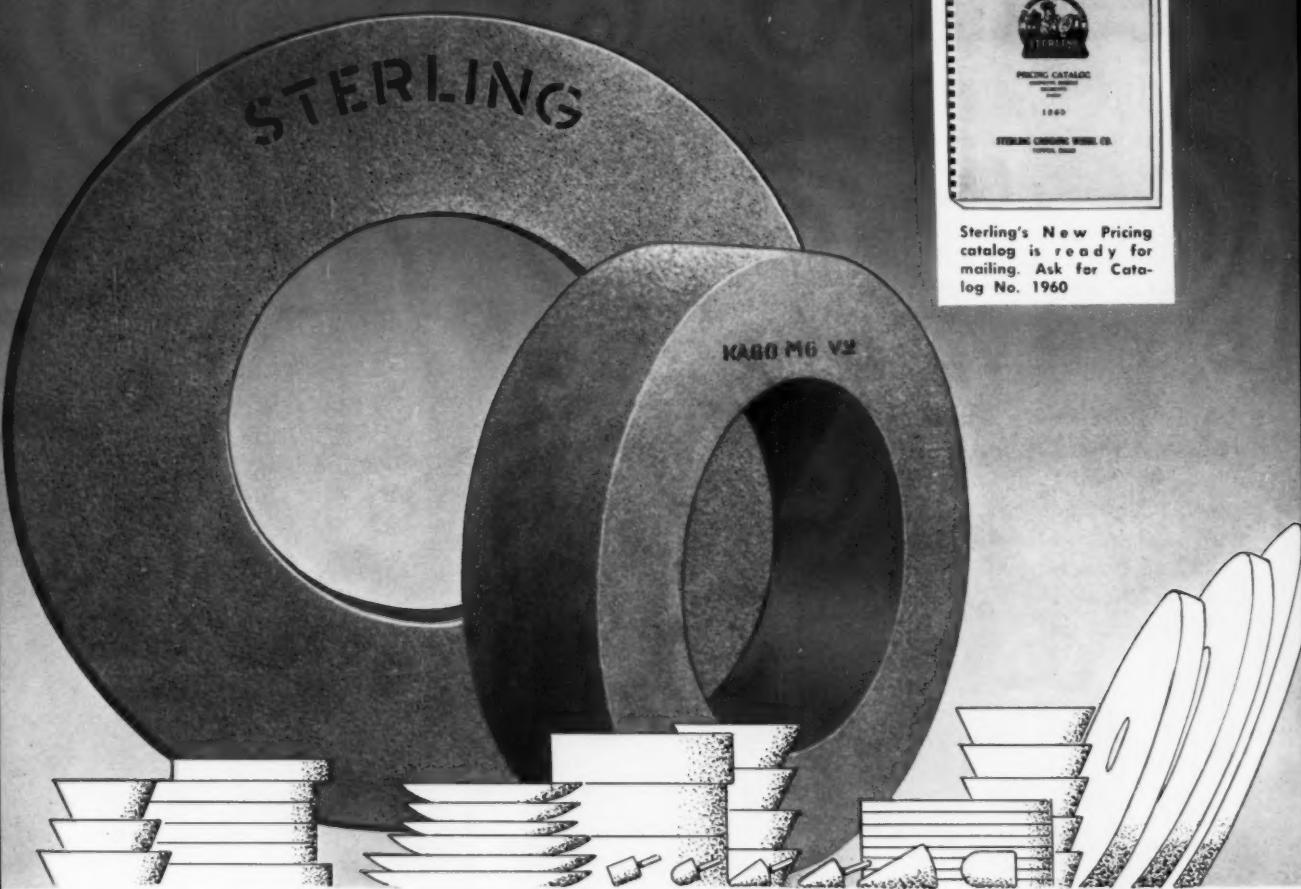
There's only one Graph-Mo--and the Timken Company makes it. It's the only tool steel that combines the advantages of machinability, wearability and stability. 250 sizes of precision ground flats give you maximum savings on many applications. For stock list, call your local Timken steel distributor or write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

**TIMKEN GRAPHITIC STEELS ARE AVAILABLE FROM STEEL SERVICE CENTERS IN 40 CITIES IN THE UNITED STATES AND CANADA**



# WRESTLING

WITH PRECISION GRINDING PROBLEMS?  
LET STERLING "WHEELS OF INDUSTRY"  
SOLVE THEM!



Sterling's New Pricing catalog is ready for mailing. Ask for Catalog No. 1960

Sterling's "Wheels of Industry" are engineered to your special needs for precision and faster production.

Although Sterling Grinding Wheels are custom-made to many specific job demands, there is no extra charge for premium performance.

Their built-in quality is evident on every job.

Stop wrestling with grinding problems! At no obligation, try a Sterling test wheel on one of your more difficult jobs. Write or wire us today and an experienced abrasives engineer will call and provide a quick solution.

**STERLING**  
**GRINDING**  **WHEELS**

STERLING GRINDING WHEEL CO., TIFFIN, OHIO—Distributors and Direct Representatives Located in All Principal Cities

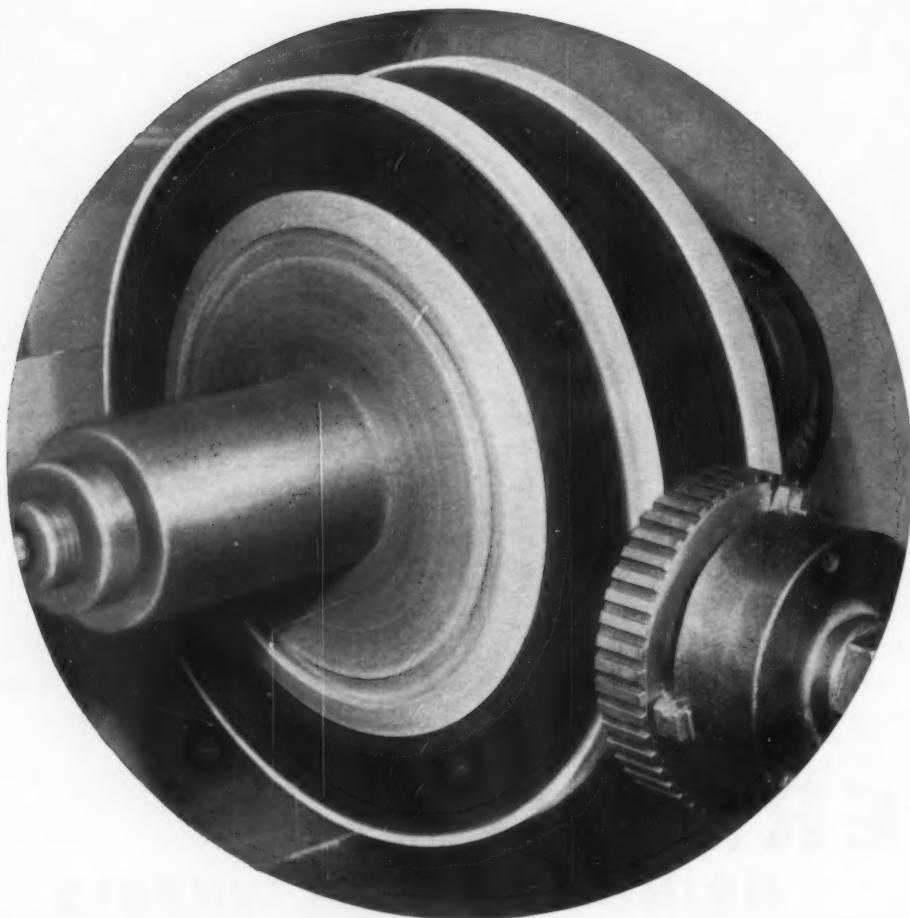
## BREAKTHROUGH IN METAL FINISHING! NEW OSBORN MASTER BLEND\* BRUSHES

... a totally new kind of power brush . . . in construction . . . in the unusually wide range of metal finishing jobs it can accomplish . . . in extra service life. You have never used a power brush like this before! • MASTER BLEND features fast-action straight wire cutting points blended with a tough plastic bond. Result: an exceptional precision power brushing tool that goes far beyond any brush you've ever used • Keeps its sharp profile for precision control over the working area throughout its long service life. Won't flare out • Scores big advantages over other accepted finishing methods. Can't rip or tear. Won't load up • Has extraordinary cutting power. Edge-blends and deburrs perfectly. Peening is kept to an absolute minimum, and—in many cases—is entirely eliminated. No compound required • Finishes more parts per hour, more parts per brush. Two years of research and on-the-job tests proved it.

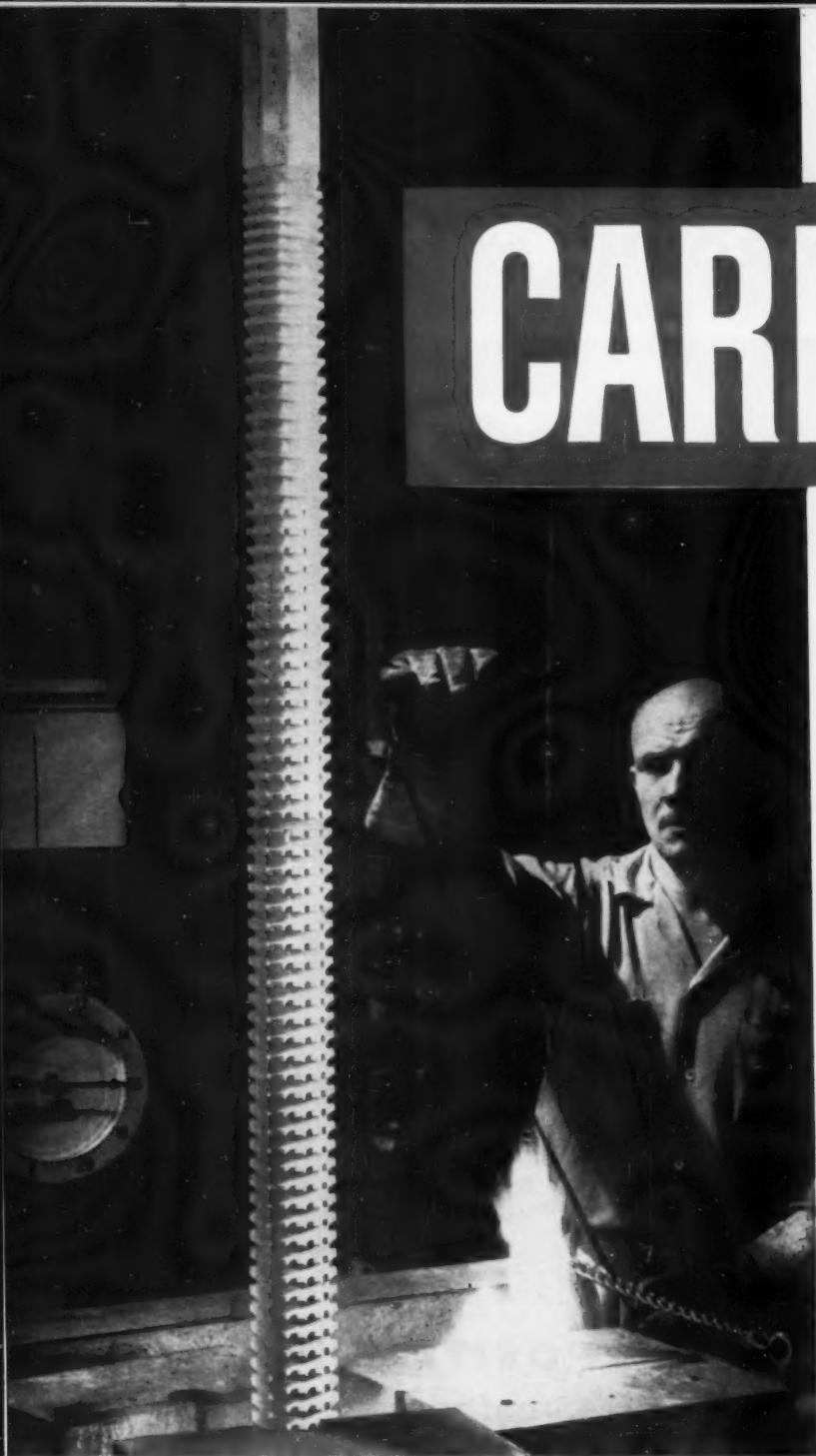
MASTER BLEND will outperform . . . outlast . . . any other power brush available. FREE BULLETIN MB-100 includes MASTER BLEND Brush sizes, types, applications. Write or call *The Osborn Manufacturing Company, Dept. D-61, Cleveland 14, Ohio. Phone ENDicott 1-1900.*

\* Trademark

Metal Finishing Machines . . . and Finishing Methods  
Industrial Brushes • Foundry Production Machinery



# CAREFUL!



With the sure, careful touch of an experienced hand, veteran CTW heat-treat man hoists 72" broach from a vertical furnace.

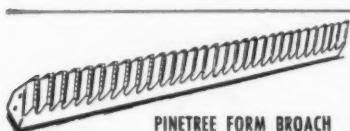
Care in the creation of Continental Broaches takes precision manufacturing a step beyond the exactness of quality control. Thirty years of broachmaking—designing and producing thousands of standard and custom-made broaches—assures unmatched efficiency and performance from CTW Broaches.

Find out how Continental's experience in broach engineering, modern heat treat methods and cost-saving production processes can cut downtime and increase output in your operation. Call your local Ex-Cell-O representative, or contact Ex-Cell-O Detroit; in Canada, Colonial Tool Co., Ltd., Windsor.

59-14

**CTW**  
**Continental** **TOOL**  
**WORKS**  
DIVISION OF

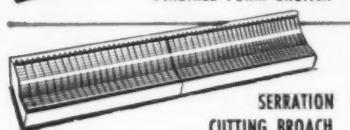
**EX-CELL-O**  
CORPORATION  
DETROIT 32, MICHIGAN



PINETREE FORM BROACH



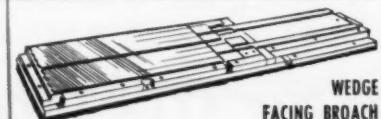
SPRAL  
SPLINE BROACH



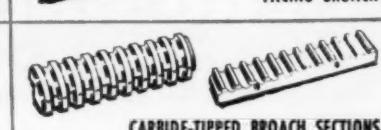
SERRATION  
CUTTING BROACH



INVOLUTE SPLINE  
SHELL-TYPE BROACH



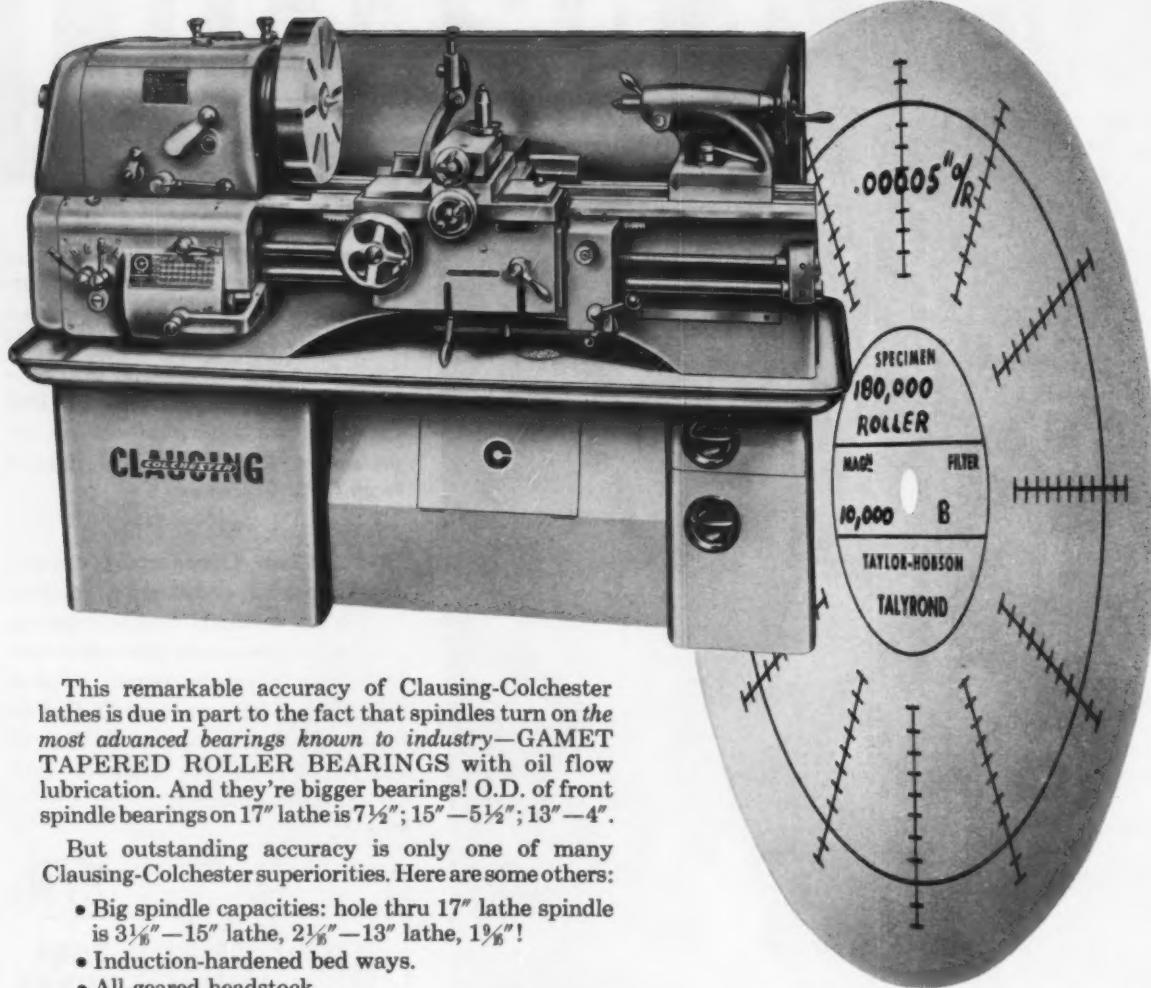
WEDGE  
FACING BROACH



CARBIDE-TIPPED BROACH SECTIONS

# CLAUSING COLCHESTER GEARED-HEAD LATHES

*turn ROUND within .0001"*



This remarkable accuracy of Clausing-Colchester lathes is due in part to the fact that spindles turn on *the most advanced bearings known to industry*—GAMET TAPERED ROLLER BEARINGS with oil flow lubrication. And they're bigger bearings! O.D. of front spindle bearings on 17" lathe is  $7\frac{1}{2}$ ";  $15\frac{1}{2}$ ";  $13\frac{1}{4}$ ".

But outstanding accuracy is only one of many Clausing-Colchester superiorities. Here are some others:

- Big spindle capacities: hole thru 17" lathe spindle is  $3\frac{1}{8}$ "— $15$ " lathe,  $2\frac{1}{8}$ "— $13$ " lathe,  $1\frac{1}{8}$ "!
- Induction-hardened bed ways.
- All-gearied headstock.
- Oil bath lubricated headstock and quick-change gear box.
- Separate feed rod for power feeds.

Best of all, Clausing-Colchesters are the greatest lathe values you'll find anywhere. Prices for the 13" straight bed model start at \$2440; 15"—\$3415; 17"—\$5100. Prices include motor and magnetic controls. Gap bed and profiling lathes available in all three sizes.

Get ALL the facts. Write for descriptive literature on the "Greatest Buys in Lathe History!"

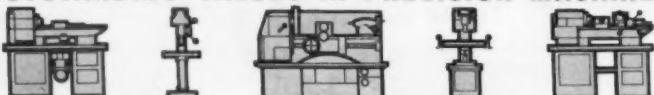
## POSITIVE PROOF!

Every Clausing-Colchester must turn round within .0001". Accuracy is checked by inspecting a turned work piece on a Talyrond which measures and records in millionths on a graph like the above. Work piece and graph are supplied with each lathe as proof of its superior accuracy.

356

**CLAUSING**  
DIVISION OF  
ATLAS PRESS COMPANY

OUTSTANDING VALUES IN PRECISION MACHINES



12-310 N. PITCHER STREET, KALAMAZOO, MICHIGAN



# Tool Steel Topics



## *Plastic grille for air conditioner molded*



### *with Lustre-Die*

This plastic grille for an air conditioner was molded at the rate of one per minute by Midwest Plastics Corporation, Wichita, Kansas. Using a die made of Lustre-Die tool steel, they produced a perfectly formed grille, with a high sheen. The grille measures 21½ x 15 in., and is ½ in. thick.

#### *Why Lustre-Die is ideal for plastic molders*

Lustre-Die tool steel is ideal for plastic molders because it can be put right to work, without the need for heat-treatment. It's easy to machine, and it polishes beautifully . . . making possible an eye-appealing sheen on finished plastic parts.

Lustre-Die is an electric furnace steel. It has a well-balanced basic analysis. By adding a special alloy fortification, which increases its depth of hardenability, its fine mechanical properties are further improved. Because Lustre-Die is heat-treated in the mill by means of oil-quenching and tempering, it comes ready for machining and polishing. It is also carefully controlled during manufacture to insure freedom from porosity.

You can always count on a fine molding job when you use Lustre-Die. But don't take our word for it. Put Lustre-Die to work in a trial run. Your Bethlehem tool steel distributor can supply you.



#### **BETHLEHEM TOOL STEEL ENGINEER SAYS:**

##### *Watch Out for Abrasion Caused by Scale*

and the cost, of each individual job.

One frequently hears the question: "What can be done in tooling to avoid this decrease in production?"

When punches and dies are normally made from water-hardening carbon tool steel (W-1 or W-2), or from manganese oil-hardening steel (O-1), the shortening of tool life can be avoided by changing to a high-carbon high-chromium tool steel, such as Bethlehem Lehigh H (D-2). This change usually overcomes the dis-

advantage of using the hot-rolled sealed stock.

However, if high-carbon high-chromium grades are already being used, there is only one method by which an appreciable improvement can be realized—the use of special heat-treatment operations. Typical treatments are short-cycle hardening, and nitriding. Complete details regarding these types of treatment may be obtained by writing Bethlehem Steel Company, Bethlehem, Pa.

When punch-press operators are occasionally unable to obtain the required sheet stock in the usual cold-finished form, they substitute hot-rolled stock. However, this causes the service life of the punches and dies to drop to one-half or one-third of normal, or less. This result is largely due to the abrasion of the scaled hot-rolled surface on the cutting edges of the tools. Determining whether such a substitution is economical depends upon the results which are expected,

**STANDARD'S Carbide-tipped  
Expandable Shell Chucking Reamer, with**

# replaceable shells

**TAKES THE  
COST OUT OF  
CARBIDE  
REAMERS!**



\*When the Carbide Tipped Shell has worn to its tolerance limit, it can be expanded to the original diameter by forcing the shell up the tapered arbor. The expansion feature is for wear compensation only.

**\*WHEN SHELL HAS BEEN FULLY EXPANDED... JUST REPLACE IT!**  
This eliminates the expense of buying complete new reamers. The replacement shell is provided with suitable grind stock, and can be finished to size after assembly.

\*The Standard Shell Type Expansion Chucking Reamer is designed for low-cost, high-precision reaming. It is ideally suited for mass production of parts having close tolerance holes.

**\*STANDARD'S TECHNICAL HELP ALWAYS AVAILABLE!**  
STANDARD'S Engineering Department welcomes queries about your reaming problems. It is possible that with this expert help you can realize greater savings and higher production of parts calling for close tolerances.

**CALL the STANDARD Man** in your area, he will show you STANDARD'S complete line of SOLID and CARBIDE TIPPED Quality Cutting Tools.



**STANDARD'S**  
Authorized Distributors  
Stock-ready for immediate  
delivery—the **COMPLETE  
FAMILY OF STANDARD  
QUALITY CUTTING TOOLS**,  
Twist Drills... Reamers... Taps...  
Dies... Milling Cutters... End Mills  
...Counterbores... Hobs... Carbide  
Tools and Gages.

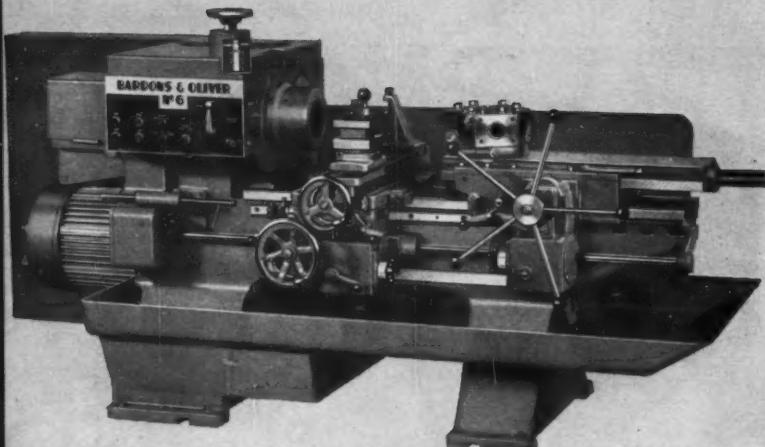
# STANDARD TOOL Co.

3950 CHESTER AVENUE

CLEVELAND 14, OHIO

BRANCH WAREHOUSES IN: NEW YORK · DETROIT · CHICAGO · DALLAS · LOS ANGELES · SAN FRANCISCO





#### RAM TYPE TURRET LATHES

Size	Bar Capacity	Swing Over Bed
No. 2 Geared Electric	1" or 1 $\frac{1}{4}$ "	13 $\frac{1}{2}$ "
No. 3 Universal	1 $\frac{1}{2}$ " or 2"	15 $\frac{1}{2}$ "
No. 4 Universal	2" or 2 $\frac{1}{2}$ "	18 $\frac{1}{4}$ "
No. 6 Universal	3" or 5"	21 $\frac{1}{8}$ "
SADDLE TYPE TURRET LATHE		
No. 21 Universal	3" or 4 $\frac{1}{2}$ "	21 $\frac{1}{4}$ "

### BARDONS & OLIVER

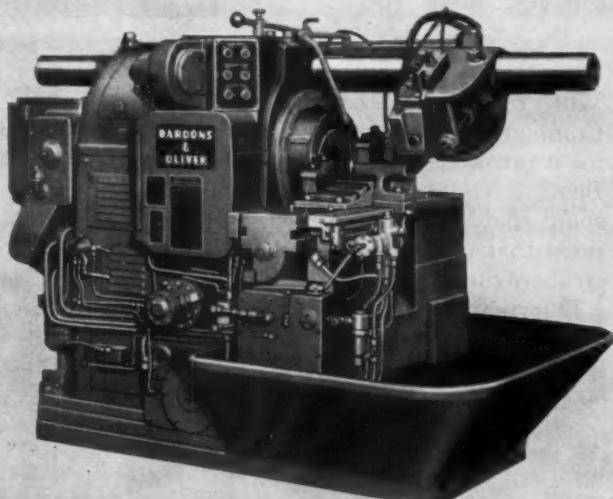
#### Turret Lathes . . . .

Each of the five Turret Lathes listed is a completely different machine, designed specifically for one range of work. All units on each machine, including the cross slide and carriage, and the turret slide and saddle, are "sized" for a particular work range. Thus adequate strength and rigidity is provided, maximum productive capacity is offered, and at the same time minimum operator effort is required. A complete line of tooling and attachments is available for each size of machine.

#### Cutting-Off Lathes

The Cutting-Off Lathes are designed to chamfer, form and cut off pipe, tubing, or bar stock with maximum efficiency. The number of pieces produced per hour often equals or exceeds that of much more expensive and complicated multiple spindle machines. Automatic loading tables, chamfer attachments, forming attachments, and automatic unloading devices are available for all sizes of Cutting-Off Lathes. These lathes are built as fully automatic, semi-automatic or hand operated.

CUTTING-OFF LATHES	
Size	Capacity
No. 32	2"
No. 33 and 34	3" and 4"
No. 35 and 36	5 $\frac{1}{2}$ " and 6 $\frac{5}{8}$ "
No. 38 and 39	8 $\frac{1}{8}$ " and 9 $\frac{5}{8}$ "
No. 312 and 314	12 $\frac{3}{4}$ " and 14 $\frac{1}{2}$ "
No. 316	16"



## BARDONS & OLIVER

**BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO**

Manufacturers of Turret Lathes and Cutting-Off Lathes

# Need Versatility?

**O.D.M. Tool and  
Manufacturing Co.  
got the versatility  
they needed in this  
Verson Press**



When the O.D.M. Tool and Manufacturing Company, McCook, Illinois, went shopping for a press, they knew what they wanted. Being a contract stamping tool and die shop, they needed a rugged, yet versatile press that could be operated economically on short run jobs . . . they bought a Verson.

Shown above, the Verson 150 ton double crank press is performing a restrike operation on 10 gauge tank turret parts, previously formed in the same press. Slide and bolster area is 42" x 72"; floor space, 98" x

143"; weight, 52,000; power adjustment of the slide, 8"; stroke, 14". Additionally, the press is equipped with two Verson "U" type pneumatic die cushions, separately adjustable.

If your shop must handle a wide variety of jobs as part of daily routine, a press from Verson's extensive line may be your most effective profit builder. Verson Application Engineers will be pleased to go over your requirements and help you select the press best suited to your needs. Call or write today.

*Originators and pioneers of allsteel stamping press construction*

**VERSON ALLSTEEL PRESS CO.**

9309 S. Kenwood Avenue, Chicago 19, Illinois • 8300 S. Central Expressway, Dallas, Texas

MANUFACTURERS OF MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES  
TRANSMAT PRESSES • IMPACT MACHINING PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES • HYDRAULIC SHEARS

248

TRADE **Verson** MADE

**Only  
ALLEN-BRADLEY  
LIMIT SWITCHES  
FINISHED TEST with  
NO FAILURES!**

*...and remained good  
for many more millions  
of trouble free operations*

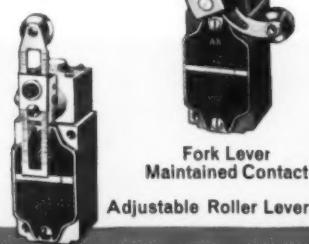
Recently, a large user of limit switches selected two identical units from each of five leading manufacturers and subjected them to the same accelerated life test. When the test was stopped after many, many millions of operations, only Allen-Bradley Bulletin 802T oiltight limit switches were left *with no failures!* Also, a careful inspection of these two Bulletin 802T limit switches suggested that they were still good for *many more millions* of operations.

The Allen-Bradley "built-in" quality is the reason for such unmatched performance. With switch bodies and operating heads positively sealed against oil and dirt, A-B Bulletin 802T limit switches are free from contact fouling and sluggish operation. The precision switch mechanism has a positive snap action—it is impossible for vibration to cause contact chatter. The double break, silver contacts never need servicing.

Insist on Allen-Bradley Bulletin 802T oiltight limit switches—they will *always* provide you with the long, trouble free life that is so important to continuous production. Send for details on the complete A-B limit switch line.



Side Push  
Rod  
Type



Fork Lever  
Maintained Contact  
Adjustable Roller Lever



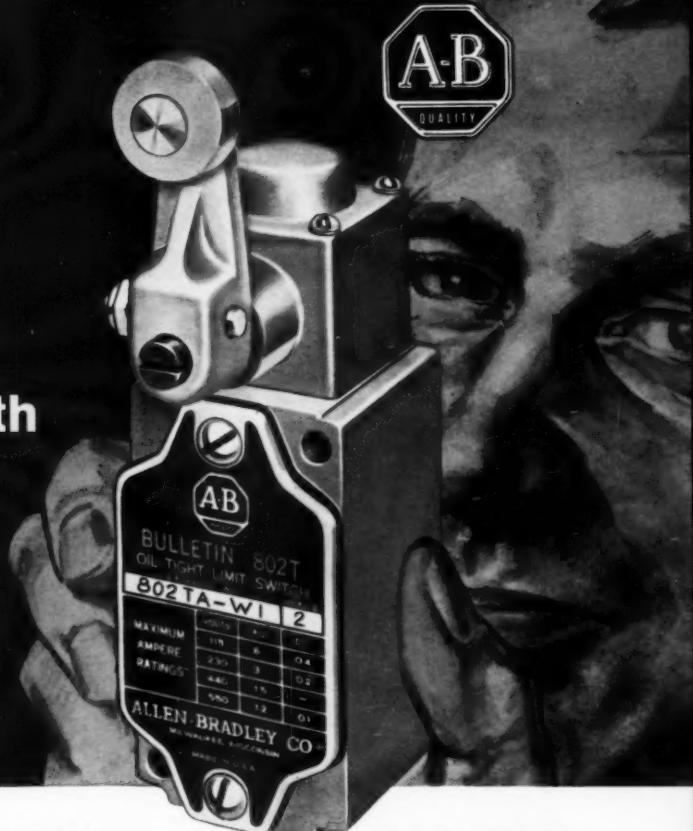
Side Push Roller



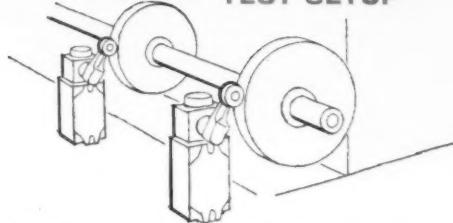
Micrometer  
Adjustment  
Roller Lever



Wobble  
Stick  
Type



TEST SETUP



**Purchased through regular supply channels . . .**

and tested under identical conditions, insuring an impartial evaluation of performance. Of the ten limit switches tested (two each of five different makes), only three were operating when the test was stopped. Two were A-B Bulletin 802T switches and one of another make, of which the second unit had failed early in the test. On this accelerated life test, one unit switched 1.0 ma at 115 v dc while the other unit switched 10 ma at 115 v dc.

**ALLEN-BRADLEY**

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

**QUALITY  
MOTOR  
CONTROL**



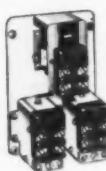
*For Consistent  
Accuracy...*

*Specify*  
**ALLEN-BRADLEY  
TIME DELAY RELAYS**

A-B BULLETIN 849  
Pneumatic Timing Relay



Single operation  
time delay relay



Dual operation  
time delay relay



Compound operation  
time delay relay

A few of the varieties of  
A-B pneumatic timers

For maximum production, high-speed automatic processes demand that the required operations "start" and "stop" at the correct instant, time after time—*without variation*. For consistent accuracy and trouble free operation, no timing relay on the market can equal the performance of A-B Bulletin 849 pneumatic timers. The delay period can be varied from 1/20 of a second to 3 minutes, and the setting will hold with an accuracy of  $\pm 10\%$ . Conversion from ON-DELAY to OFF-DELAY (or vice versa) is simple—no adjustment is necessary. Like all A-B control, these quality timers have maintenance free, double break, silver contacts. The two sets of contacts—one N.O. and one N.C.—are electrically independent, for greater control flexibility. Also, auxiliary contacts can be easily added.

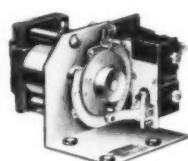
To make certain of a completely satisfactory electrical installation, specify Allen-Bradley "quality motor control"—in addition to the Bulletin 849 pneumatic timing relays. Write for details, today.



BULLETIN 848  
Fluid Dashpot  
Timing Relay



BULLETIN 852  
Electronic  
Timing Relay



BULLETIN 850  
Motor Driven  
Process Timer

Allen-Bradley makes a broad line  
of timing relays to satisfy all  
automatic processes.

82-150-RM

# ALLEN-BRADLEY

Member of NEMA

*Quality  
Motor  
Control*

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ontario

let's talk



# CAPACITY

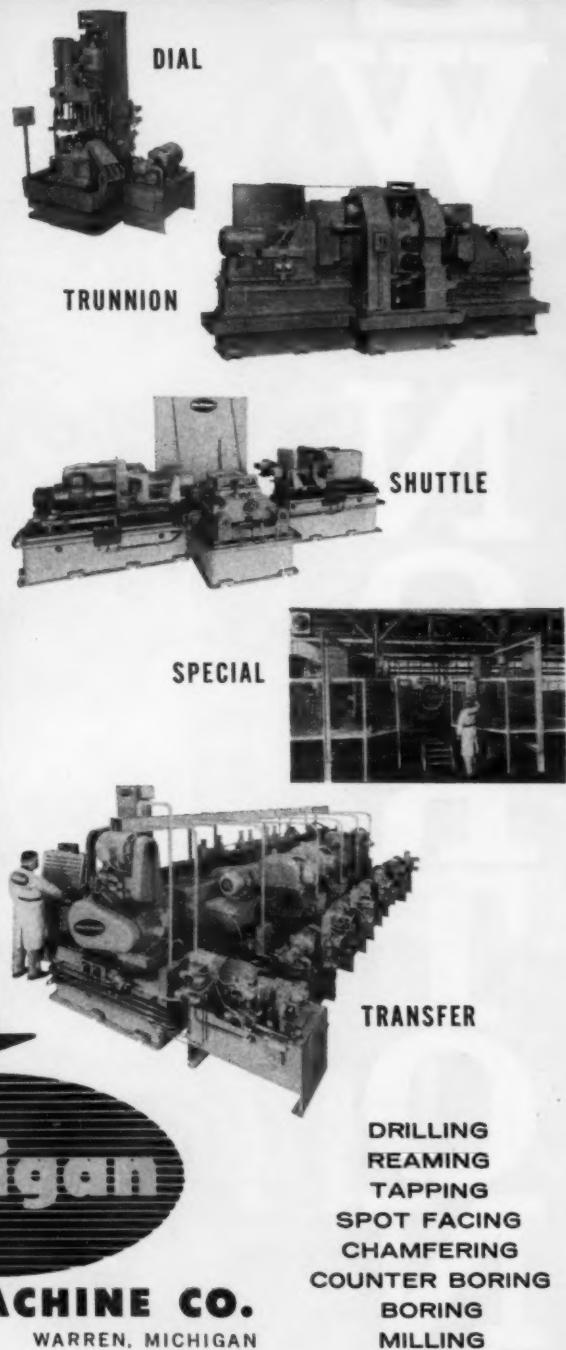
**CAPACITY**, what does this represent in terms of dollars to a prospective buyer of metal cutting machines.

We at **MICHIGAN** feel that manufacturing **CAPACITY** is an important asset and most beneficial time saving aid available. We constantly strive to improve our manufacturing and assembly methods, this in turn increases our **CAPACITY**. The ability to manufacture machines in less time, results in a low product cost to the customer.

- Modern Building.
- Excellent plant facilities.
- Complete engineering.
- National sales staff.
- Blueprint and duplicating departments.
- Manufacturing facilities to machine every detail in all of our many components.
- **MICHIGAN** designs and fabricates electrical, hydraulic and lubrication installations.

All this represents **CAPACITY**.

**MICHIGAN'S CAPACITY** pays off in savings to our customers. If you're looking for a special metal cutting machine of any kind, remember **MICHIGAN**—we specialize in dependable delivery, low product cost and excellent service. Send us your inquiries, we will be pleased to serve you promptly.



TRANSFER  
DIAL EQUIPMENT  
TRUNNION  
SHUTTLE  
GUN DRILLING  
TAPE CONTROL  
DRILL HEADS  
FIXTURES

**SPECIAL MACHINE CO.**

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DRILLING  
REAMING  
TAPPING  
SPOT FACING  
CHAMFERING  
COUNTER BORING  
BORING  
MILLING

**NEW**  
*from*  
**NORTON**



# *Segments of new 23 ALUNDUM\* abrasive . . . premium performance at non-premium price*

Surface grinding gets a real performance-lift from Norton — combined with a definite economy!

Newest development for segments for vertical spindle surface grinders is 23 ALUNDUM abrasive.

This is no ordinary aluminum oxide. Here you get premium toughness and sharpness — plus the friable nature that eliminates dressing.

Two other big advantages are versatility and uniformity. 23 ALUNDUM abrasive is ideal for surface grinding carbon steels, mild steels, stainless steels, Meehanite and aluminum. And to this broad range 23 ALUNDUM segments bring maximum uniformity of performance — the results of a two-year Norton project to develop the closest possible duplication of structure and dimensions.

#### *Users already know these benefits*

Segments of 23 ALUNDUM abrasive have had thorough test runs from coast to coast. The following reports from Norton surface grinding customers are typical:

- "With the new segments we get freer cutting and higher production rate."
- "Very good on all our metals. Required no dressing."
- "No burn, even with full power. Better finish, longer life on all metals. We're standardizing on '23'."
- "Best segments we've ever used for general purposes, including chrome plate."
- "Much less dressing, faster cut, less heat."

Find out how 23 ALUNDUM segments can benefit your own production. See your Norton Distributor about a test run in your plant. Or your Norton Man will give you plenty of facts about this big, new advancement in surface grinding. NORTON COMPANY, General offices, Worcester 6, Massachusetts. Plants and distributors around the world.

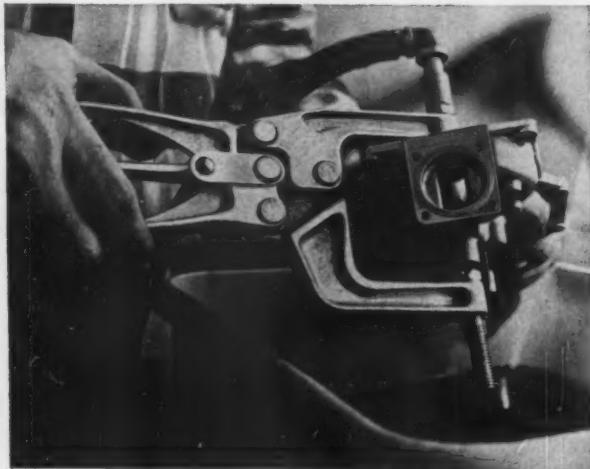
W-2001



\*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

**Making better products . . . to make your products better**  
NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

# Look what clamps are doing!

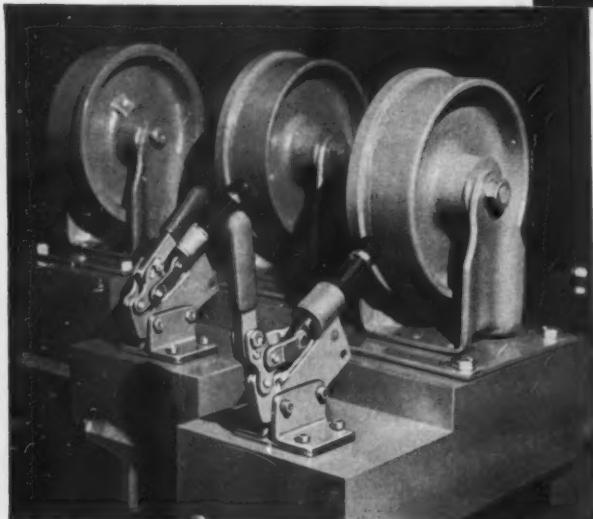
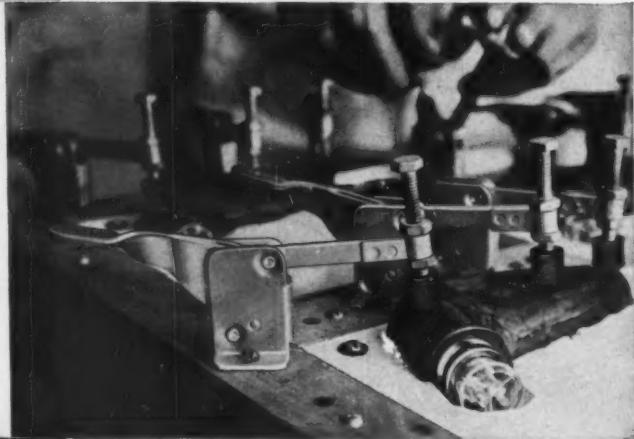


## *Practical uses of Wespo Toggle Clamps and Pliers that may suggest ways you can save*

**Toggle plier serves as low cost fixture for testing castings**  
The air line is connected through one jaw of a Wespo Model 522 Toggle Plier. The plier is then clamped onto the casting and air applied by a foot control. Immersing the casting into a tank quickly spots any defects. Patented "Quick trigger" feature of the Model 522 instantly releases the casting; speeds testing. Rugged, lightweight Wespo toggle pliers are available in various jaw capacities and sizes.

**Holding these glued parts together while drying** is a simple task with Wespo Horizontal Bar-Type Toggle Clamps. Neoprene-capped spindles prevent damage to plastic surfaces, yet securely hold the parts during the drying operations. Wespo toggle clamps are available in more than 80 types and sizes. So, the next time you think clamps, think Wespo!

**Simple, low cost "parking brake" for this track-operated frame** is provided by a Wespo Push-Pull Clamp equipped with a neoprene-capped spindle. "Brake" is quickly applied or released by a simple flick of the wrist. Wespo Push-Pull Clamps are available in various sizes and holding pressures and are ordinarily used on holding fixtures where push or pull clamping is required.



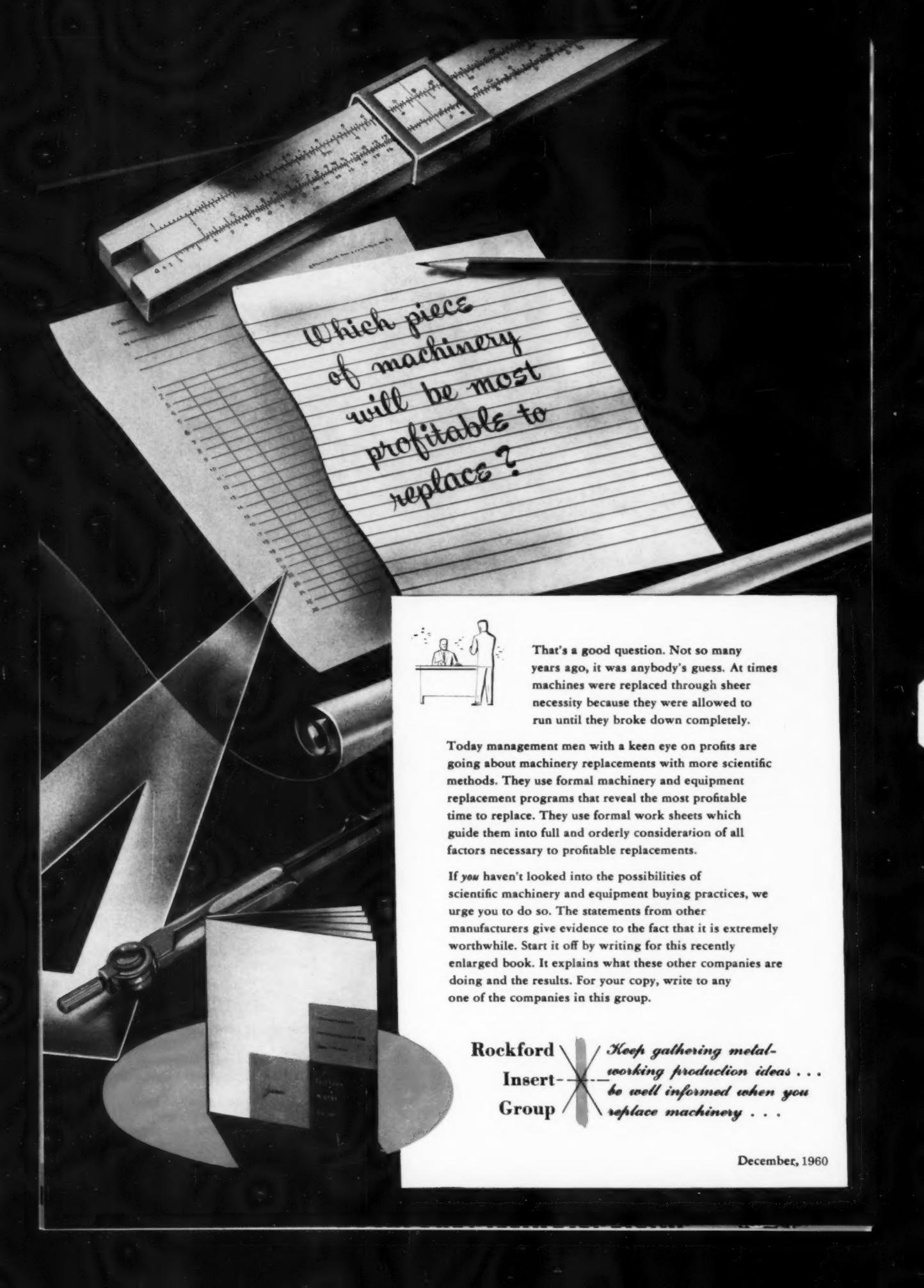
### **FREE CLAMP CATALOG!**

*Ask your Wespo distributor  
for your free copy of this  
16-page Wespo catalog. It  
will help you quickly select  
the right clamp for every  
clamping job.*



# **WESPO**

DIVISION OF VLIER ENGINEERING CORPORATION  
26935 W. Seven Mile Rd., Detroit 19, Michigan  
Formerly West Point Manufacturing Company



Which piece  
of machinery  
will be most  
profitable to  
replace?



That's a good question. Not so many years ago, it was anybody's guess. At times machines were replaced through sheer necessity because they were allowed to run until they broke down completely.

Today management men with a keen eye on profits are going about machinery replacements with more scientific methods. They use formal machinery and equipment replacement programs that reveal the most profitable time to replace. They use formal work sheets which guide them into full and orderly consideration of all factors necessary to profitable replacements.

If you haven't looked into the possibilities of scientific machinery and equipment buying practices, we urge you to do so. The statements from other manufacturers give evidence to the fact that it is extremely worthwhile. Start it off by writing for this recently enlarged book. It explains what these other companies are doing and the results. For your copy, write to any one of the companies in this group.

Rockford  
Insert  
Group

Keep gathering metal-  
working production ideas . . .  
be well informed when you  
replace machinery . . .

**MATTISON**  
HIGH-POWERED  
PRECISION

**GRINDING  
METHODS**

Functionally new—compact enough for in-line installations—yet more rigid, powerful, and productive than most grinders in its capacity range. Mattison's new wide belt grinder can help you boost stock removal rates, reduce costs, and improve finishes on metallic or nonmetallic materials, coil or sheet stock, and small pieceparts.

A massive three-roll head uses up to 150 hp on the belt drive, automatic belt tensioning, and a vibration-free contact roll—concentrates maximum belt length in minimum floor space. The unitized head adapts to an in-line or conveyorized bed, reciprocating table, or vertical way-and-column construction.

### *Belt pulled through work imparts superior surface finish*

Drive roll of the No. 457 pulls abrasive into the work around a freewheeling contact roll, and simultaneously provides belt tensioning. That's why the belt cuts smoothly at uniform rate, and lasts longer. Should belt stretch, multiple air cylinders automatically adjust drive roll to maintain dial-set tension.

Contact roll is completely separated from the driving function—imparts smooth finishes free from motor pulsation and chatter marks. A third roll automatically aligns and flexes belt for cool, positive cutting.

# New, wide belt grinder compact in design but big in performance



A long, 14-ft belt assures fast cooling, better flexing, clean cutting. Large windowed doors speed belt changes.

### *Guaranteed grinding accuracies*

Rigid, close-coupled construction of the massive Mechanite frame prevents deflection, deadens vibration, enables us to guarantee tolerances of  $\pm .0015$ " over 72" width,  $\pm .001$ " over 60" width.

Grinding coil or sheet stock, manually adjusted set-height controls maintain constant billy roll setting. For thick work, micrometer bed-setting controls assure positive final size and tolerance.

### *Wet or dry grinding*

For flood-type cooling, grinding fluid is flushed through built-in troughs in the heavy bed to an outside rear tank—you always have an ample supply of cool, filtered cutting fluid. Optional spray attachment provides mist-type belt lubrication.

For comfortable, efficient dry grinding, a dust-collection manifold in the fully enclosed machine may be positioned close to the actual point of grinding.

### *Grinds within $\frac{1}{4}$ " of sheet ends*

A photoelectric cell senses the lead edge of sheet stock entering the feed rolls. Grinding contact is established within  $\frac{1}{4}$ " of the lead end. Electric-eye pickup actuates two large diaphragm-type cylinders, raising the billy roll and guiding sheets into contact with the belt.

Uniform grinding pressure, maintained within  $\frac{1}{4}$ " of the trailing edge, gives you continuous quality control, maximum efficiency, and positive protection against sheet edges injuring the belt with subsequent marking of the surface.

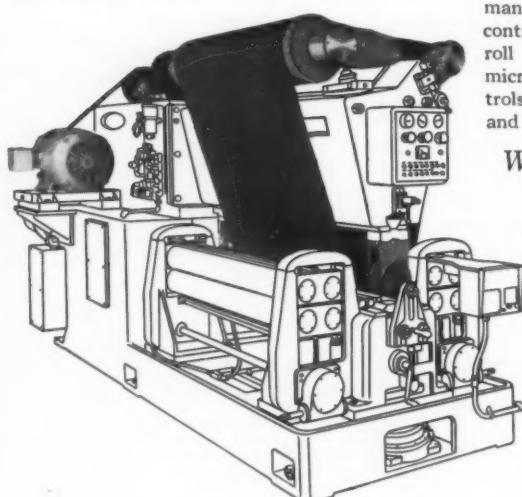
For details on our complete line of wide belt grinders, contact your Mattison representative or write the factory.

*If it's a flat surface,  
there's a Mattison to grind it!*

**MATTISON MACHINE WORKS**  
Rockford, Ill. • Phone WO 2-5521



**HIGH-POWERED  
PRECISION  
SURFACE GRINDERS**



Machinery, December, 1960

CENTER OF MACHINE-TOOL EXCELLENCE

**ROCKFORD, ILLINOIS, U.S.A.**

## Now ••• 3½" Capacity With This New Greenlee

Biggest of the Greenlee Bar Automatics!

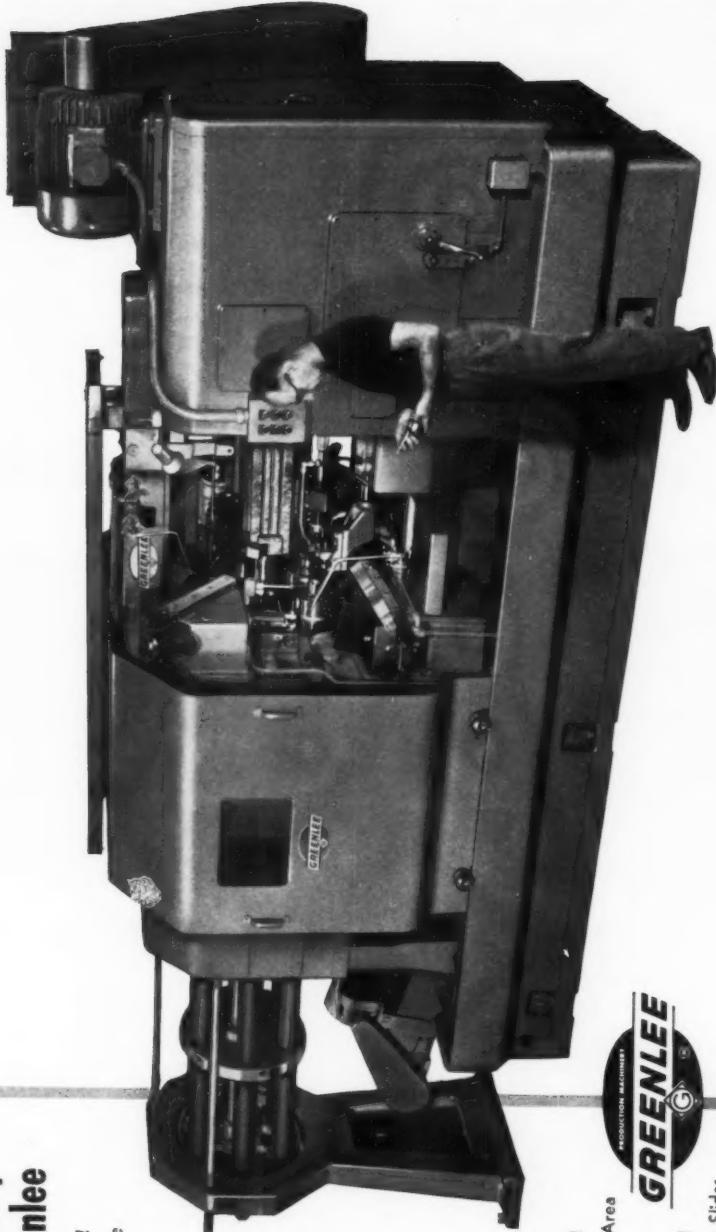
This new 3½" - 6 spindle model offers the most outstanding advantages in the field.

It is exceptionally versatile. It offers

well-known Greenlee dependability.

Like all Greenlee Automatics it has independent, cam-operated cross slides and wide-open tooling area. Greater flexibility, accuracy and productivity are built into this big, powerful Greenlee Automatic. Check these outstanding advantages:

- Permanently Aligned Spindle Carrier
- Positive, High-Speed Carrier Indexing
- Wide-Open, Easily Reached Tooling Area
- Sturdy, Cam-Feed Main Tool Slide
- Interchangeable Cross Slide Camming
- Micrometer Adjustment On All Cross Slides
- Rapid-Shift, Dual-Range Speed and Feed Gears
- Built-in Lead Screw Threading Feed and Drive



**GREENLEE®  
BROS.  
& CO.**  
1944 MASON AVENUE, ROCKFORD, ILL.

Other Greenlee 6 Spindle Bar Automatics  
are offered in 1", 1½", 2" and 2½" capacities.

TRANSFER MACHINES • SPECIAL MACHINES • SIX AND FOUR SPINDLE AUTOMATICS • TRIM PRESSES • DIE CASTING MACHINES • WOODWORKING MACHINES AND TOOLS • HYDRAULIC AND HAND TOOLS



*Precision lathes for  
tape, tracer, or  
operator control*

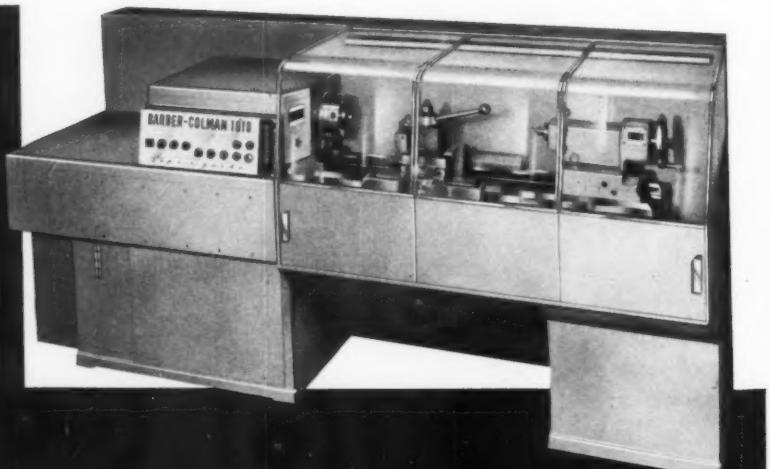
Here you see the core of the new Barber-Colman lathe line. To prove the *new* ideas claim, take just two examples, the Tape-r-guide (directly below) and the 1610 tracer lathe (lower right, opposite page).

News about the Tape-r-guide? Without complex electronics, with just electromechanical controls, this machine can do cutoff and boring as well as internal and external step-turning, smooth tapers, and even some radii. Simplicity itself, it does its work with a single-point tool . . .

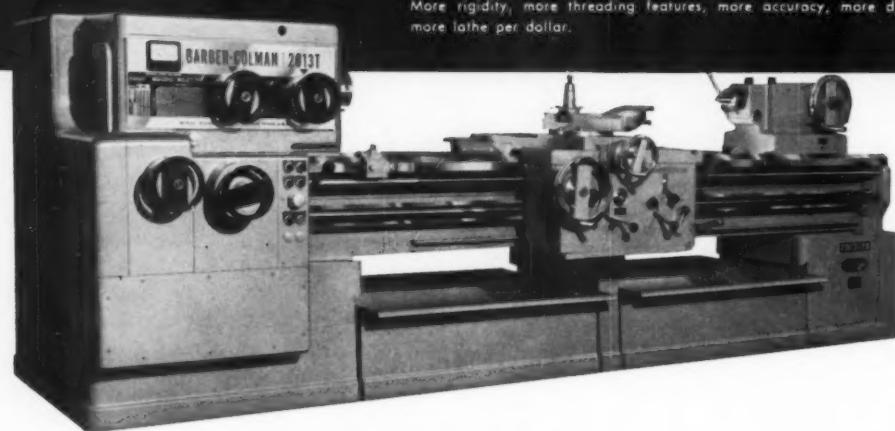
## The new ideas in turning

**new**

**NEW Tape-r-guide** (16" and 20") — First basically mechanical lathe with fully integrated 8-channel binary code control system. Automatically performs stop-start, positioning, speed adjustment, and feed change functions; machines all practical tapers without "hunting" or step formation; produces simple radii; cuts chamfers without special tools; performs cutoff and boring operations and machines at 90° to the work axis — all without feedback or complex electronics. Low capital equipment investment — simple, low-cost operation and maintenance.



**NEW 2013, 36-speed lathe** (21" and 25") — All-new, geared-head precision lathe for high-speed production or toolroom turning . . . used in production shops with throw-away insert tools at speeds up to 750 rpm. For fast, accurate production of medium- and short-run jobs. Spindle speeds to 1500 rpm (200 rpm optional); 66 thread cutting and feed changes; 400-lb. two-speed tailstock; separate lead screw and feed shaft. More rigidity, more threading features, more accuracy, more design refinements — more lathe per dollar.



**new**



Machinery, December, 1960

CENTER OF MACHINE-TOOL EXCELLENCE

**ROCKFORD, ILLINOIS, U.S.A.**

completely controlled by the tape. And about the 1610 tracer? This is the "specialist," a concept which for the first time strips off the toolroom equipment and offers a facing and turning lathe that is frankly a production tool. Tracer control multiplies its productivity by making it semiautomatic.

Both these new machines are innovations, and are signs of the unencumbered thinking that goes on at Barber-Colman. It is part of the heritage that has brought to Barber-

Colman precision lathes such important design advantages as sealed gearboxes, controls that are simplified and grouped, hardened and ground bedways, the use of precision antifriction bearings, and universal automatic lubrication.

You can continue to expect significant design contributions such as these in the lathes Barber-Colman will build in the years to come. But meantime, take advantage of the increased productivity of the machines offered today.

A good way to start is to call your Barber-Colman representative.

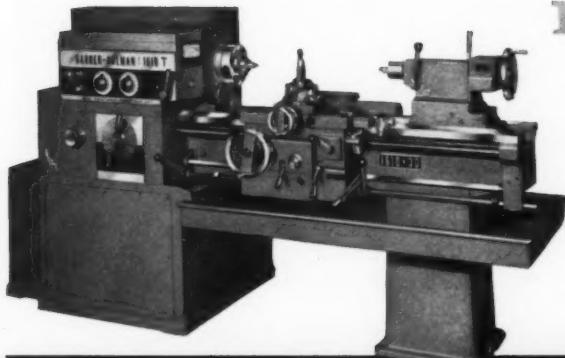
Barber-Colman Company



122 Loomis St., Rockford, Illinois

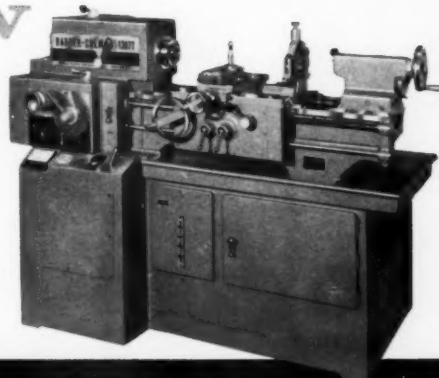
## are from Barber-Colman

new



**NEW 1610T toolroom lathe** (16 $\frac{1}{2}$ " and 20") — The lathe with the "toolroom touch." The minute you push the start button and grab the handwheel, you feel the difference toolmakers look for. Try the speed change dial for fast facing or a light finishing cut on the OD. Smooth, silent, fast acceleration under load — infinitely variable speeds to 1500 rpm in the high range.

**NEW 1610 specialist** (16 $\frac{1}{2}$ " and 20") — Proven new concept reduces both capital equipment and operating costs. For high-speed turning, facing, and boring, Class B operators readily become proficient at producing accurate nonthreaded parts up to 100% faster. Infinitely variable spindle speeds to 1500 rpm; infinitely variable power feed to both carriage and cross slide; five-position turret-type longitudinal feed stop — reduces skill requirements and speeds operation.



**NEW 1307T toolroom lathe** (13") — High capacity and timesaving controls combined with super precision. Infinitely variable speeds to 3000 rpm in belt drive can be changed under load. Combines extra capacities (13" swing and 24" between centers) with extra quality: selected Class ABEC-7 super-precision spindle bearings; ground-from-the-solid actuating screws; antifriction bearings on all shafts; Meehanite castings; hardened-and-ground headstock gears; splined shaft connections.

**NEW 1610 tracer lathe** (and 1610-13) — Can be purchased with hydraulic tracer for about the same price as a toolroom lathe of the same rated capacity and quality. Real cost-busting combination of "specialist" lathe and tracer control capable of holding diameters within 0.001".

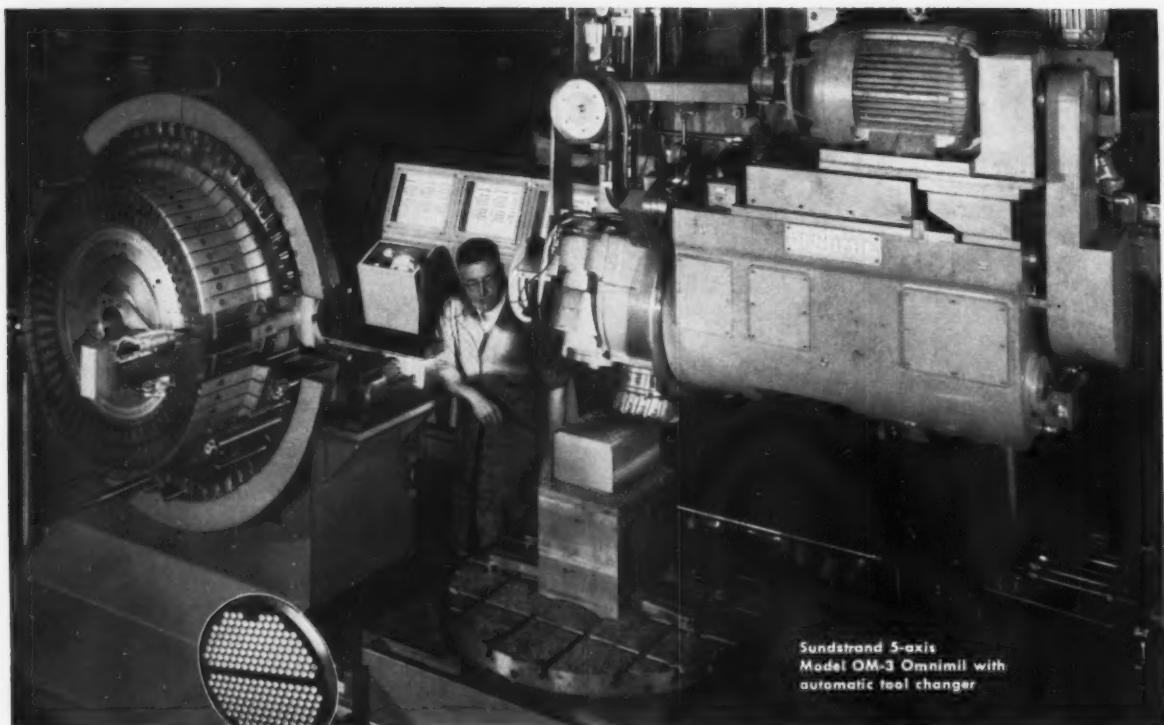


new



new





Sundstrand 5-axis  
Model OM-3 Omnimill with  
automatic tool changer

## Sundstrand “Engineered Production” concept applied to numerical control

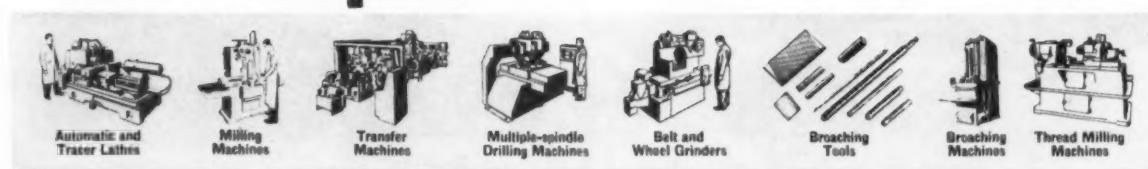
New Sundstrand machines with numerical control have been developed to meet the Sundstrand “Engineered Production” concept — which starts with the piecepart and your production requirements and then provides the machine that makes the best sense economically.

This approach takes into consideration the size of part, the operations to be performed, the number of setups involved, parts handling between machines, and the like. It has resulted in the development of a complete system of machines as clearly illustrated on the next page.

For complete information, ask for a Sundstrand “Engineered Production” analysis of your operations and send for new Bulletin No. 622 covering Sundstrand numerically controlled machine tools.



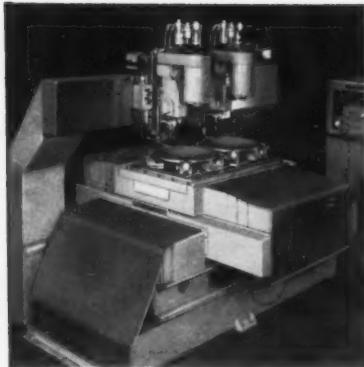
BORING • DRILLING • MILLING  
REAMING • TAPPING • TURNING



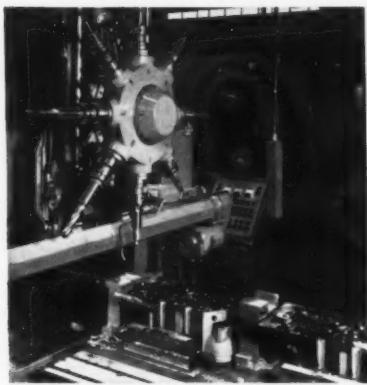
Machinery, December, 1960

MACHINES DESIGNED TO MEET YOUR NEEDS

**ROCKFORD, ILLINOIS, U.S.A.**



Simple vertical head machine incorporating Sundstrand two-axis 20" x 30" Jigmatic table. Table also available separately.



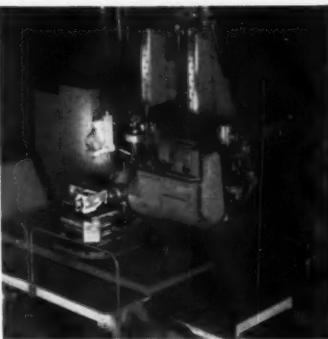
Three-axis machine with turret head and 40" x 60" table handles workpieces too large for the Jigmatic table.



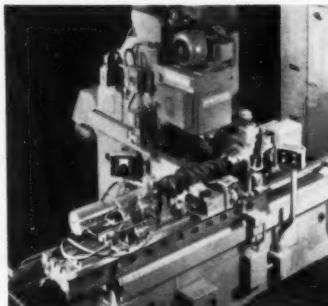
Three-axis horizontal-spindle machine for milling, boring, drilling, reaming, and tapping. Available with rotary index fixture to present all four sides of the workpiece to the cutting tools. Positioning or contouring control.

## A complete system of numerically controlled machines to best meet your requirements

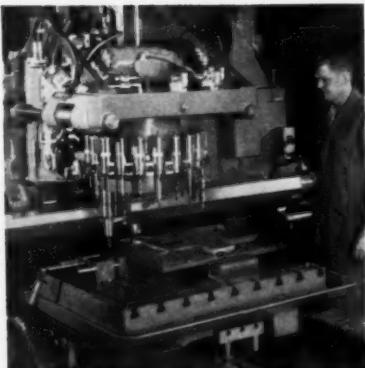
Some of the Sundstrand machines illustrated here are completely new types developed to provide the advantages of numerical control for a broad range of work requirements. Others are familiar Sundstrand machines with necessary design modifications to take the fullest advantage of numerical control. One of them is ready to fit your production problem — to replace one or more machines now performing the same operation, or to combine several operations now performed on different machines.



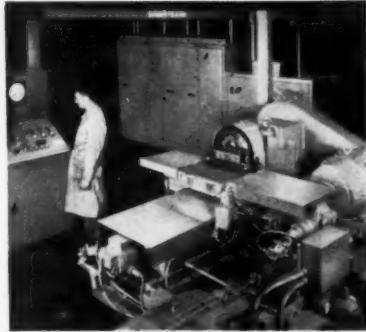
Five-axis Omnimill mills, drills, bores, reams, taps all exposed faces of the workpiece at any angle. Positioning or contouring control. Model OM-3 for parts to 2" x 2" x 2", OM-4 for parts to 4" x 4" x 4".



Sundstrand "Engineered Production" machine, built primarily of standard components, to mill locating spots on six different crankshafts.



Three-axis machine with 40" x 60" table and 20-position automatic tool changer handles drilling, boring, reaming, tapping, and light milling. Positioning or contouring control.



Sundstrand lathes with multiple tooling for straight and contour turning, controls speeds, feeds, order of presentation and cutting path of each tool.

For details and specifications on the machines illustrated, ask for Bulletin 622.



# SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION

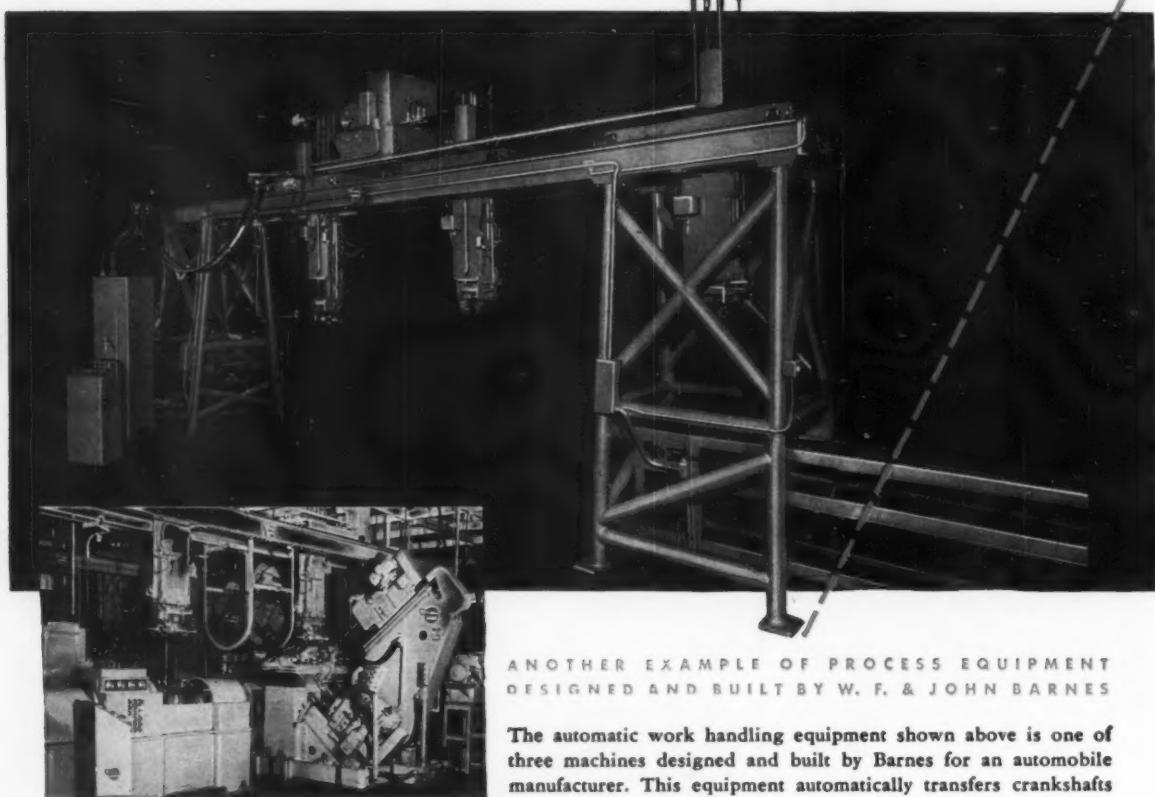
Machinery, December, 1960

FOR PRODUCTION MACHINE TOOLS IT'S

**ROCKFORD, ILLINOIS, U.S.A.**



# production efficiency increased



ANOTHER EXAMPLE OF PROCESS EQUIPMENT  
DESIGNED AND BUILT BY W. F. & JOHN BARNES

View of Special Barnes Handling Unit, Crankshaft Balancing and Barnes Drilling Machines in automobile plant. After crankshafts are conveyed to load station and manually positioned for pick-up, operating sequence is as follows: (1) Three overhead pick-up units descend, grasp workpieces, and automatically rise simultaneously to traverse position. Left-hand unit picks up unbalanced crankshaft at loading station. Center unit removes piece from Balancer and right-hand unit removes part from Drilling Machine; (2) all units traverse one station to the right and descend. This positions a new workpiece in the Balancing Machine, transfers workpiece in the Drilling Machine, and a finished part on a discharge conveyor; (3) all units automatically rise and return to initial starting position. Complete Barnes equipment also includes electrical controls, and special in-feed and discharge conveyors.

The automatic work handling equipment shown above is one of three machines designed and built by Barnes for an automobile manufacturer. This equipment automatically transfers crankshafts between the rough Balancing and Barnes Drilling Machines. By eliminating manual loading and unloading, a substantial increase in production efficiency over previous methods is effected. With this specially designed and engineered equipment, one operator now handles the entire balancing and drilling operations. All units are electrically interlocked and timed in sequence with overall production requirements.

You will find the varied engineering and creative skills at Barnes that are necessary to design and build this type of process equipment. These skills are the result of over 80 years of machine building experience. All planning, engineering, and manufacturing efforts are closely coordinated in one plant. You get a complete, dependable service from one source with no divided responsibility.

#### ASK FOR AN ANALYSIS OF YOUR WORK HANDLING METHODS

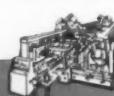
Find out how this specialized engineering and building service can help you cut costs. Write today for an analysis of your production methods or ask for new 16-page catalog entitled "Automatic Process and Transfer Equipment."

**W. F. & JOHN BARNES CO.**  
402 South Water Street, Rockford, Illinois

Multiple Spindle  
Machine Tools

Special  
Transfer Equipment

Special  
Electrical Controls



BUILDERS OF BETTER MACHINES AND EQUIPMENT SINCE 1873



Machinery, December, 1960

MACHINES DESIGNED TO MEET YOUR NEEDS

**ROCKFORD, ILLINOIS, U.S.A.**

# A MAJOR **BREAKTHROUGH**

IN "PROBLEM" DRILLING!

**Buffalo**



with

- Hollow Spindle
- Variable Speed Drive

**Buffalo** pioneered the RPMster's variable speed drive — instant speed changes while drilling.

Now, **Buffalo** brings you the RPMster with special hollow spindles to shatter concepts of formerly "impossible" drilling. Look at these test results:

**316 STAINLESS STEEL** —  $\frac{3}{4}$ " drill, 700 rpm, .001" feed — 4" deep;  $\frac{1}{2}$ " drill, 900 rpm, .001" feed —  $4\frac{1}{2}$ " deep.

**TOOL STEEL SHEAR BLADES** Hardened to 54 R c.  $\frac{1}{2}$ " drill — 800 rpm .001" feed —  $2\frac{1}{2}$ " through.

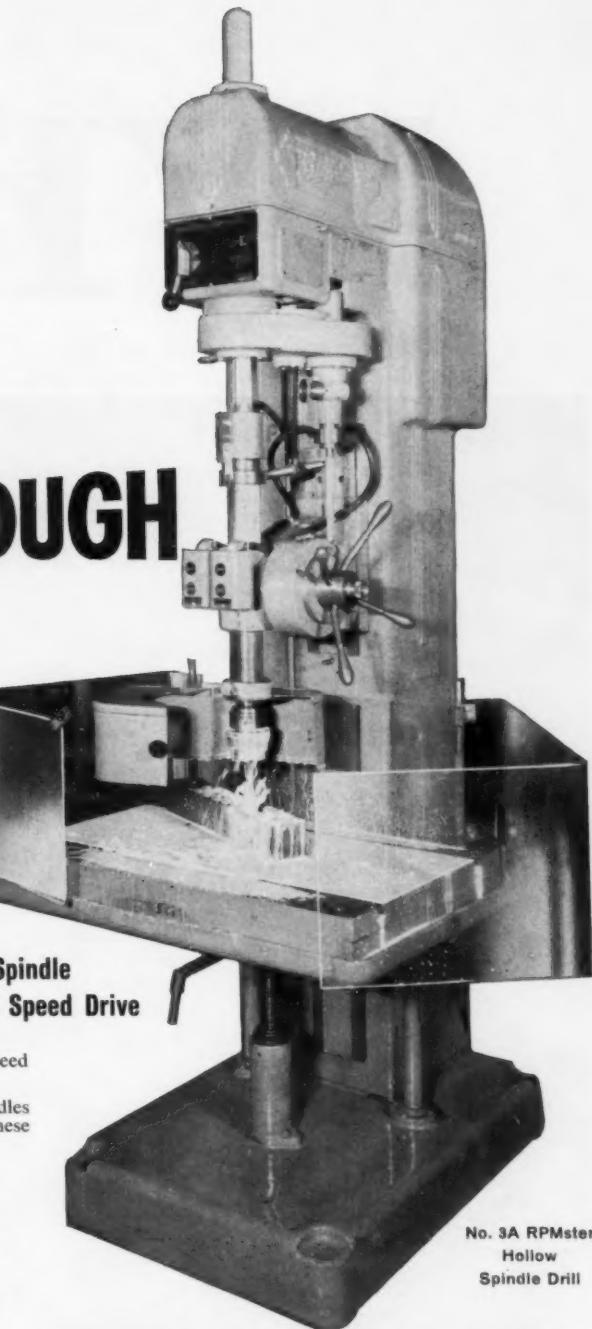
**RENE 41** —  $\frac{1}{2}$ " hole @ 750 rpm .001" — 3" through.

**BERYLLIUM BRONZE** —  $\frac{1}{2}$ " hole @ 6200 rpm hand feed through  $2\frac{1}{2}$ " in  $1\frac{1}{2}$  seconds.

**TITANIUM** —  $\frac{3}{8}$ " hole @ 1000 rpm .002" feed.

**CAST IRON** —  $\frac{3}{4}$ " hole @ 2000 rpm. 004" feed.

**52-100 ALLOY STEEL** —  $\frac{7}{16}$ " hole @ 800 rpm .001" feed.



No. 3A RPMster  
Hollow  
Spindle Drill

**SEE FOR YOURSELF.** At no obligation, send a sample of any hard-to-drill material to the factory. We will test-drill it and return the sample with a report on the drilling tests. Send your sample today, and write for details!



**BUFFALO FORGE COMPANY**

BUFFALO, NEW YORK



Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Buffalo air handling equipment to move, heat,  
cool, dehumidify and clean air and other gases.



Buffalo Machine Tools to drill, punch, shear, bend, slit,  
notch and cope for production or plant maintenance.

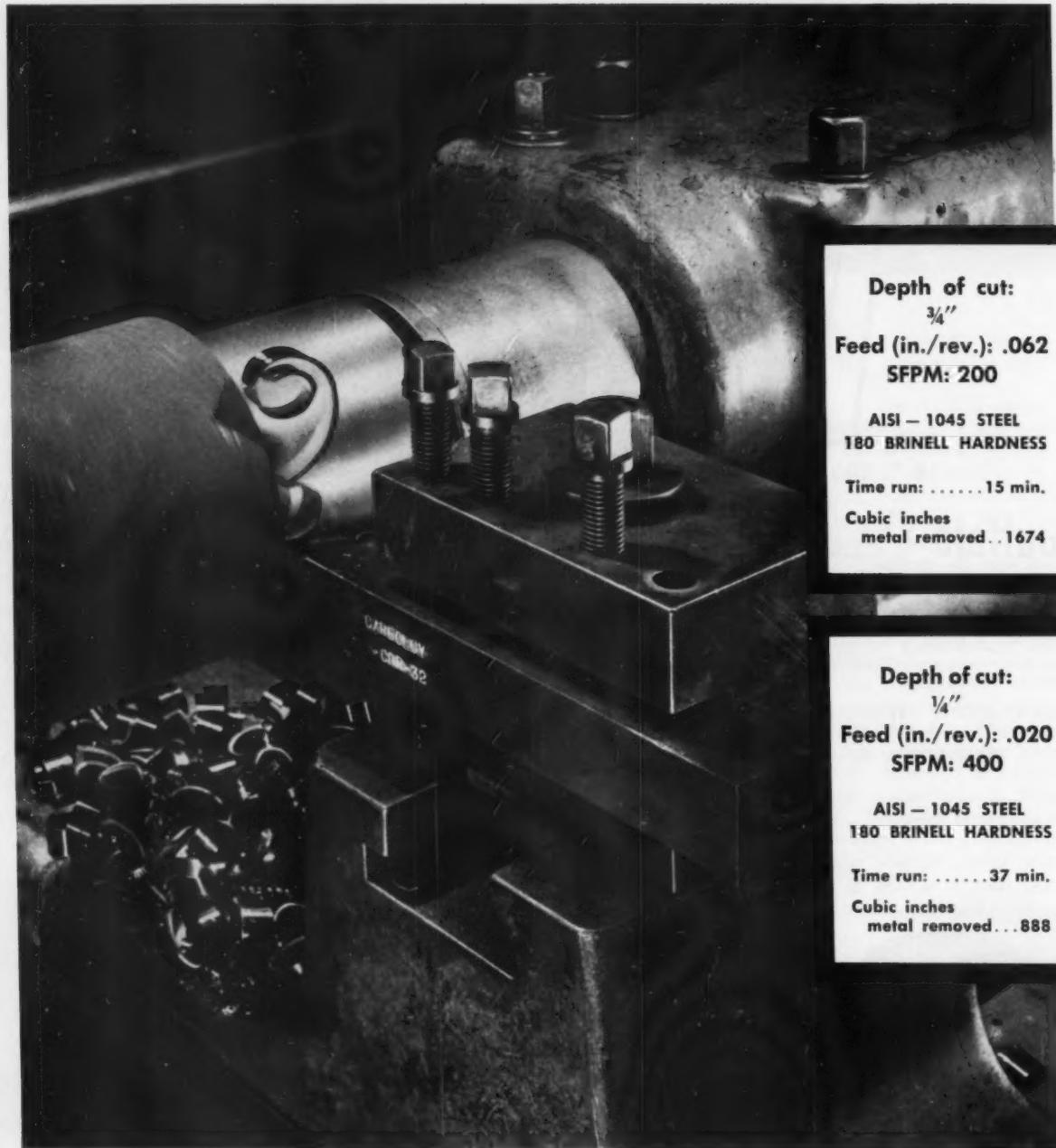


Buffalo Centrifugal Pumps to handle most liquids  
and slurries under a variety of conditions.



Squier machinery to process sugar cane, coffee and rice.  
Special processing machinery for chemicals.

# Why?



Depth of cut:

$\frac{3}{4}$ "

Feed (in./rev.): .062  
SFPM: 200

AISI — 1045 STEEL  
180 BRINELL HARDNESS

Time run: ..... 15 min.  
Cubic inches  
metal removed .. 1674

Depth of cut:

$\frac{1}{4}$ "

Feed (in./rev.): .020  
SFPM: 400

AISI — 1045 STEEL  
180 BRINELL HARDNESS

Time run: ..... 37 min.  
Cubic inches  
metal removed... 888

# Why is one Carboloy carbide grade best for light-duty steel-cutting applications; another more suitable for heavy-duty jobs? And which should you use?

Carbide selection can be scientific (and should be!) if you are going to get optimum results from your steel-cutting operation.

Take the job-graded Carboloy Grades 78B\* and 370, for example. The 78B Grade is designed to offer real economy in normal steel-cutting applications—where machine power is limited. The 370 Grade, on the other hand, was developed specifically for heavy-duty steel-

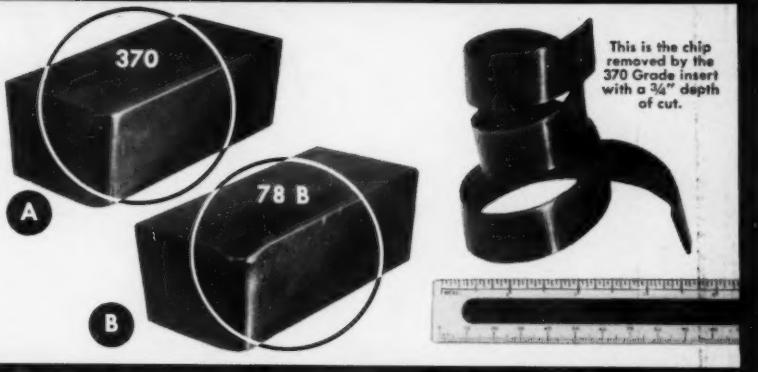
cutting jobs. Look over the following examples; then contact your Carboloy representative, or Authorized Carboloy Distributor, for information on Carboloy job-graded carbides for your specific operation. Take advantage of better profits through better tooling. Call today, or write: Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Street, Detroit 32, Michigan.

\*Carbides in 78 Series are all pre-honed. Carbides in the 300 series are available pre-honed, precision-ground, or utility-ground.

## HEAVY-DUTY MACHINING

Photograph A shows the Carboloy 370 Grade insert after the run. Wear land was only .012", and there is no deformation (upsetting) of the cutting edge. Photo B shows the 78B Grade insert after the same run. Note the deformation of the cutting edge... Grade 78B was not designed for such severe cutting pressures.

**CONCLUSION:** In this heavy-duty application, Carboloy 370 Grade is recommended.



## LIGHT-DUTY MACHINING

In this light-roughing application there is little visible difference between the Carboloy 78B Grade insert (Photo A) and the 370 Grade insert (Photo B). Because 78B Grade is job-graded for light- and medium-roughing applications, it will wear as long as 370 Grade. Grade 78B insert is lower in initial cost, so in this case it makes good sense to use Grade 78B. In this example, the wear land on 78B insert was only .010".

**CONCLUSION:** In this normal steel-cutting application, Carboloy 78B Grade is recommended.



**CARBOLOY**  
CEMENTED CARBIDES

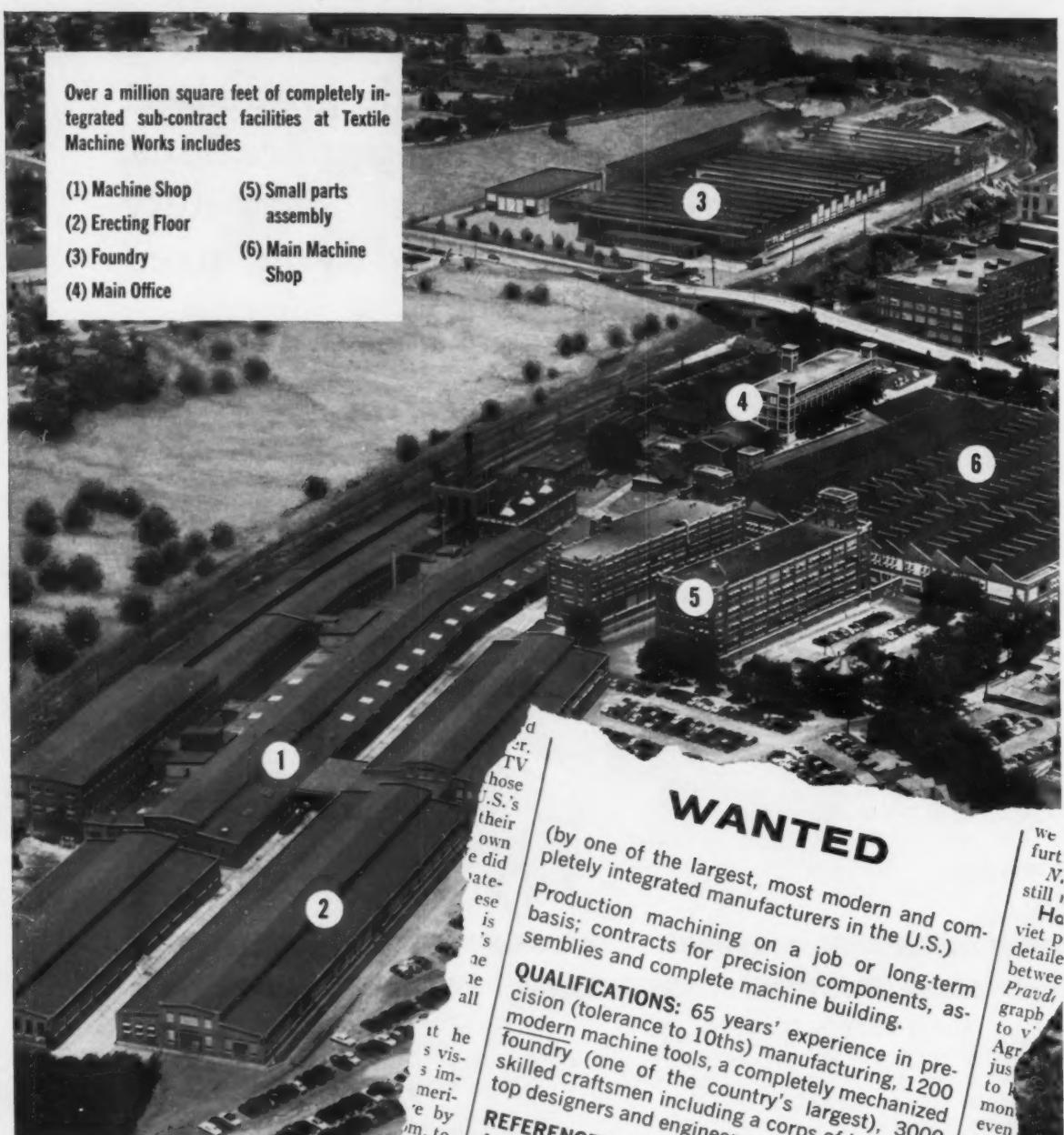
METALLURGICAL PRODUCTS DEPARTMENT

**GENERAL**  **ELECTRIC**

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITES® • VACUUM-MELTED ALLOYS

Over a million square feet of completely integrated sub-contract facilities at Textile Machine Works includes

- (1) Machine Shop
- (2) Erecting Floor
- (3) Foundry
- (4) Main Office
- (5) Small parts assembly
- (6) Main Machine Shop



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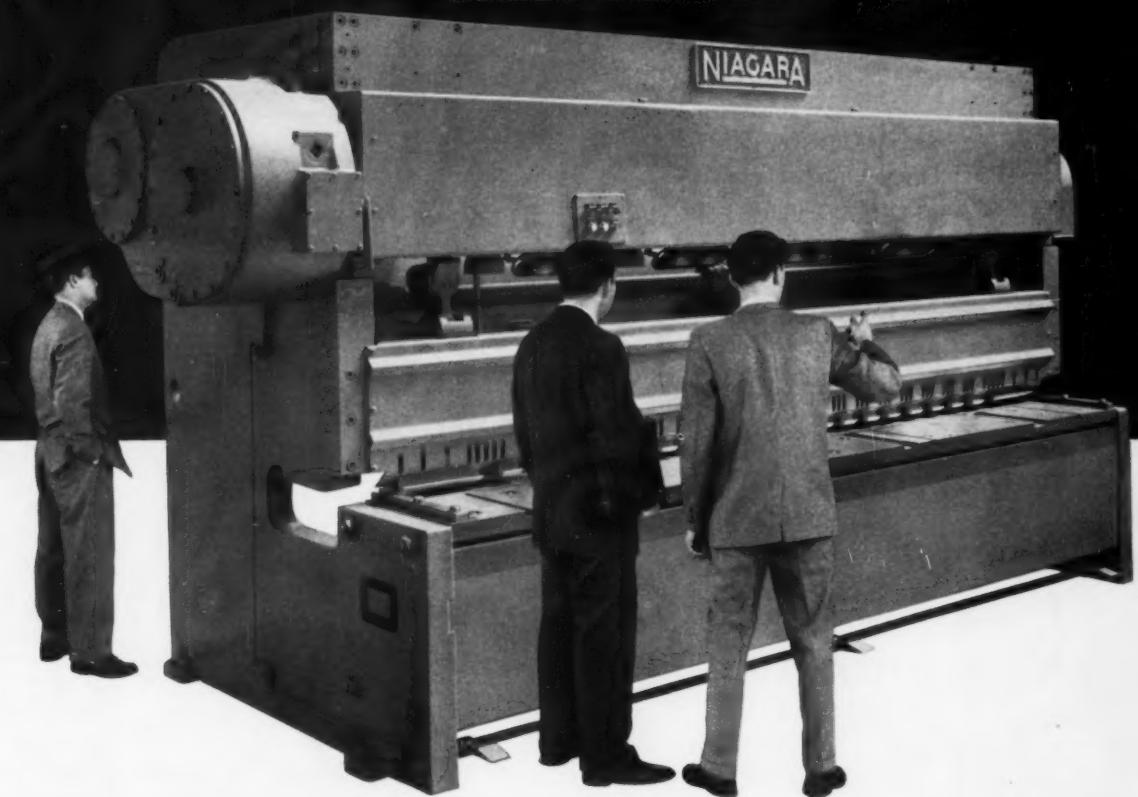
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## You can turn a profit on a New Britain **+GF+** Copying Lathe

Here's a birdseye view of a New Britain **+GF+** Copying Lathe. It shows some important differences between this machine and conventional lathes with copying attachments. The point here is this—*the most effective use of the single-tool copy-turning principle can be made only with a machine designed from the ground up for this type of work.* The New Britain **+GF+** is just such a machine. Notice the chip pan. It's big (it has to be) and located for easy removal of chips from the back of the machine. The design of the work area allows for unobstructed free-fall of chips out of the way and into the pan.

The New Britain **+GF+** is massive and rugged, with plenty of power—up to 40 h.p., if you need it. It's simple to operate, quick to set up and change over. The single-point tool can be changed in one minute and it out-produces gang tooling setups in the bargain. Turning is controlled by

either a template or a prototype. External and internal copying are accomplished in one set-up with special tooling.

The possibilities for short or long run chucked and between centers work on the **+GF+** are wide and varied. Because the work is produced with good surface finish and dimensional accuracy, grinding can be reduced and, in some instances, eliminated. Large diameters are broken down economically by successive parallel cuts, automatically if desired, with optional two-cut or multi-cut recycling.

You've got to see one of these machines in action to fully understand the kind and quantity of work they are capable of producing. Contact your New Britain Representative for demonstration arrangements or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

**NEW BRITAIN • GRIDLEY MACHINE DIVISION**

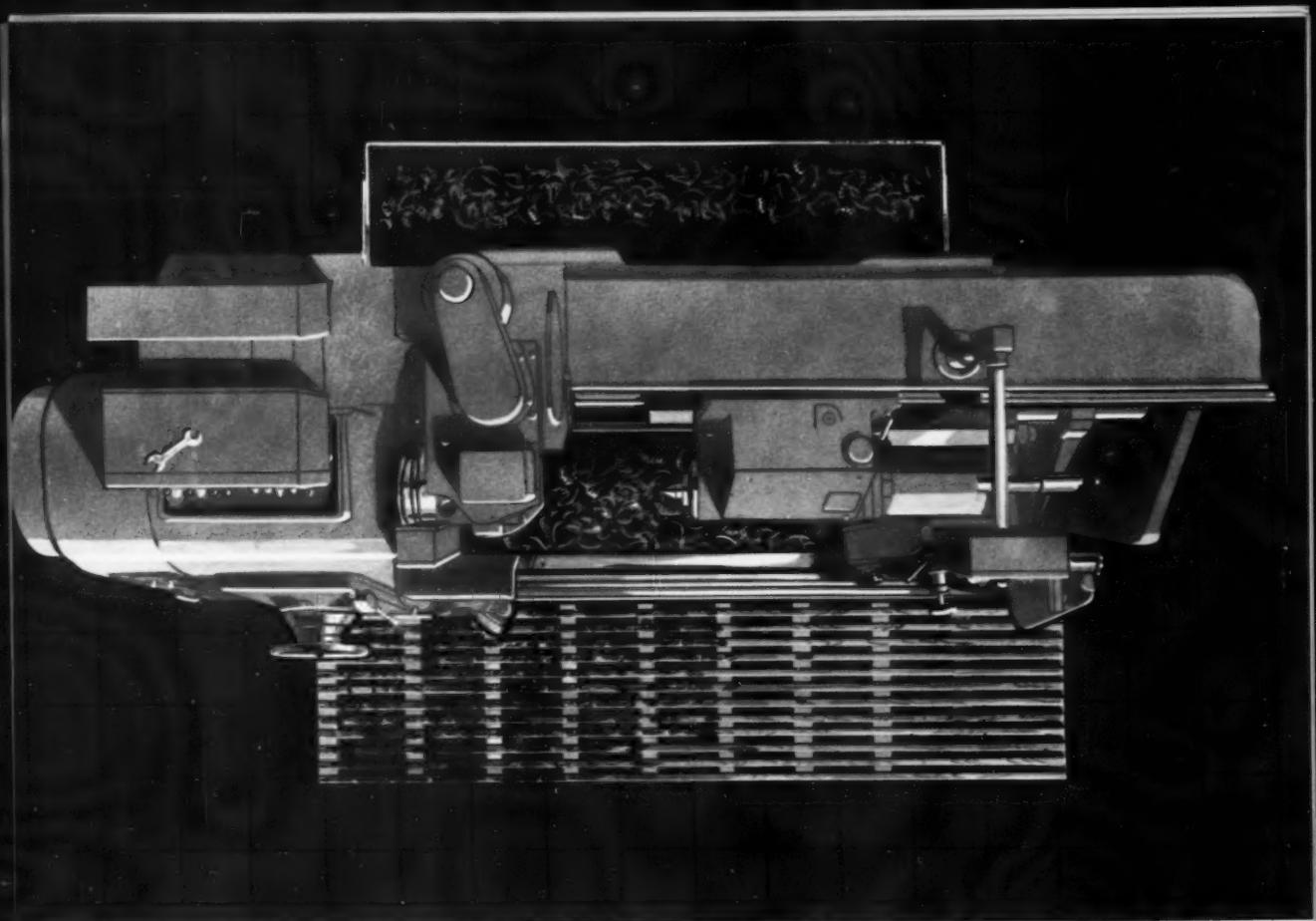
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Nothing can out-date your operation quicker than better machines in the hands of a competitor. In the race to keep ahead on quality, price and delivery, nothing can put you out front faster than machines capable of consistently producing the highest quantity of finished pieces at the lowest possible cost. New Britain's new series of bar machines represents in every way the most advanced bar-turning units available. Each of the four-, six- and eight-spindle models has been redesigned, adding new features and improving older ones. Unlimited cross slide and end-working tool combinations, extremely fast operation (even on stainless) and a variety of models and features to choose from add up to some good reasons for incorporating New Britains into your replacement

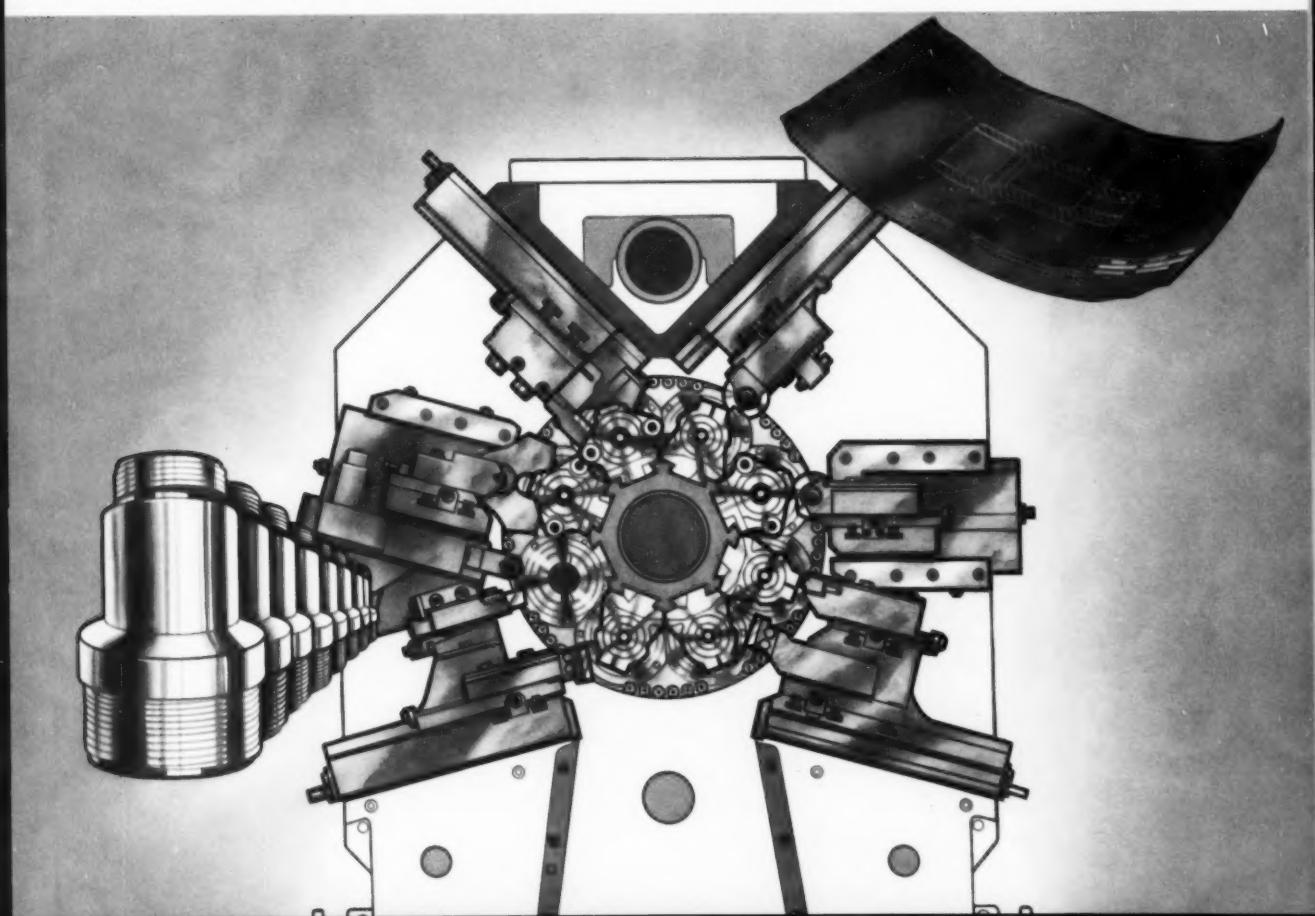
or production expansion plans.

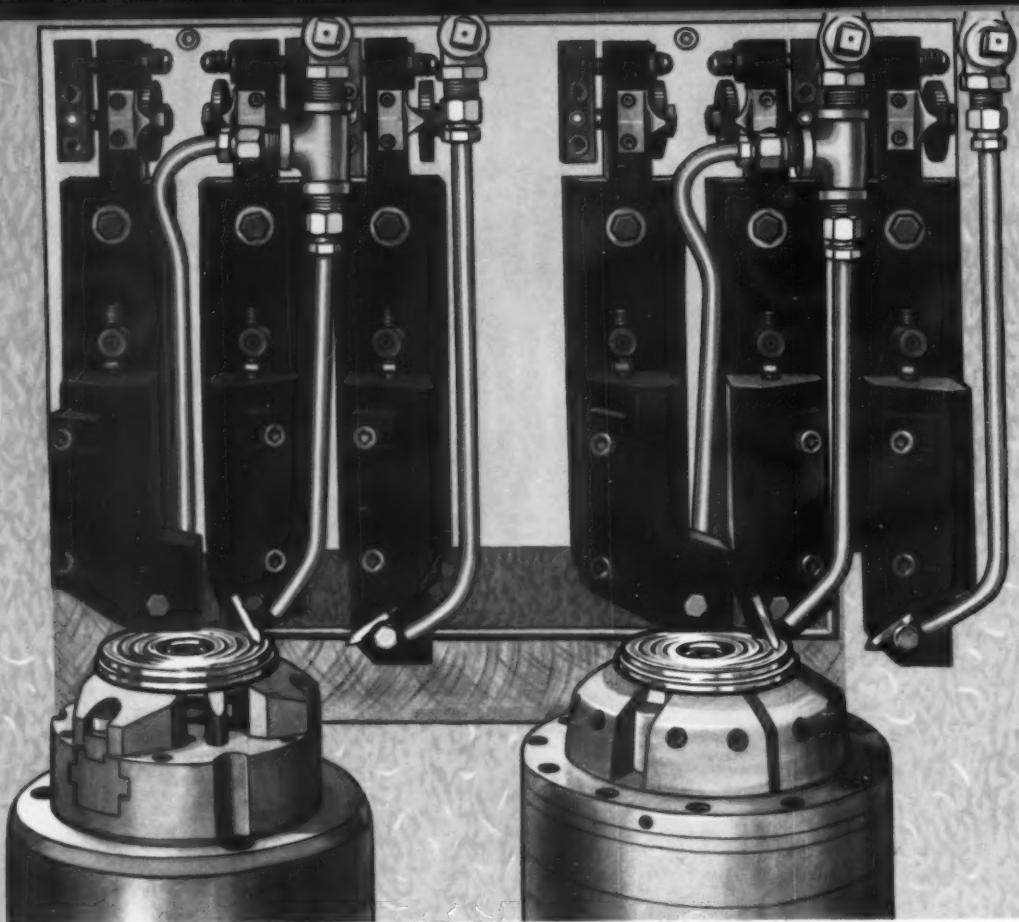
The eight-spindle model is the largest, most modern eight-spindle bar machine available. It has a stock capacity of up to  $2\frac{5}{8}$ " and provides six independently-operated cross slides. As with all New Britain bar machines, the operations of the cross slides and end-working tool slide are disc-cam controlled for positive actuation, close tolerance machining and easy, rapid change-overs.

This is only a very small part of a story that is bound to interest you. The whole story and its significance in terms of your profits is available from your New Britain Representative. If you prefer, contact us directly at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

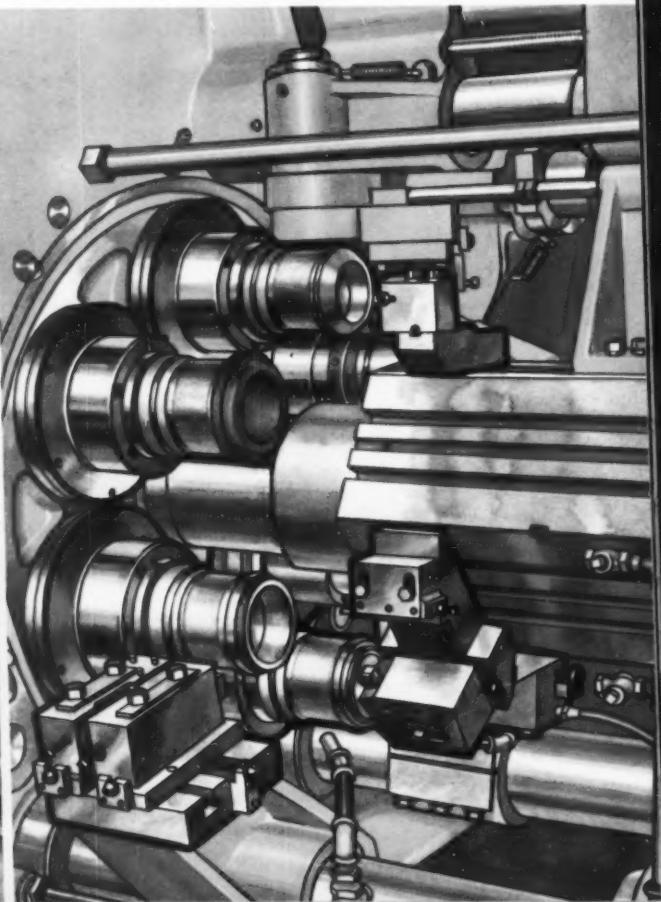
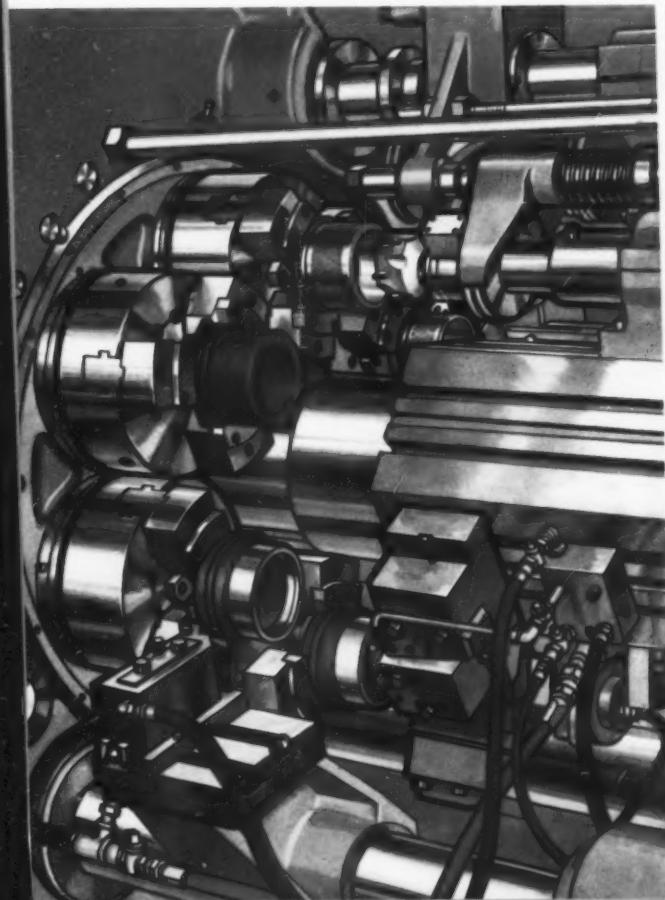


THE NEW BRITAIN MACHINE COMPANY





NEW BRITAIN - GRIDLEY MACHINE DIVISION



# New Britain's new concept for contour turning and boring

Beyond a certain point, continued refinement of existing designs in machine tools ceases to make an appreciable contribution to performance. Thus in designing our New Series of Vertical Precision Boring Machines, we have incorporated several completely new design concepts to provide improved performance and greatly increase over-all usefulness.

For the first time machines of this type can be used as building block units. Their clean-sided design permits any number of self-contained machines, each with one or more spindles, to be arranged side by side and operated as a single unit. They also may be operated with equal efficiency as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine.

In order to take the fullest advantage of the

precision inherent in cam control, long linkages between cams and slides have been eliminated. A pair of cams is mounted on a common shaft which is carried *within the vertical slide*. Since all slide actuating forces are contained in the vertical slide, both cams are directly adjacent to the slides they control and no outside forces are imposed on the slide ways. The result is maximum rigidity for heavy cuts coupled with extreme accuracy for close tolerance work.

This unique and eminently workable approach to contour turning and boring results in the highest order of accuracy on even the most complex pieces. Your New Britain Representative can give you details on the nine different models available in this series. For catalog material, write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

**T H E   N E W   B R I T A I N   M A C H I N E   C O M P A N Y**

## New Britain... still the best Chuckers you can buy

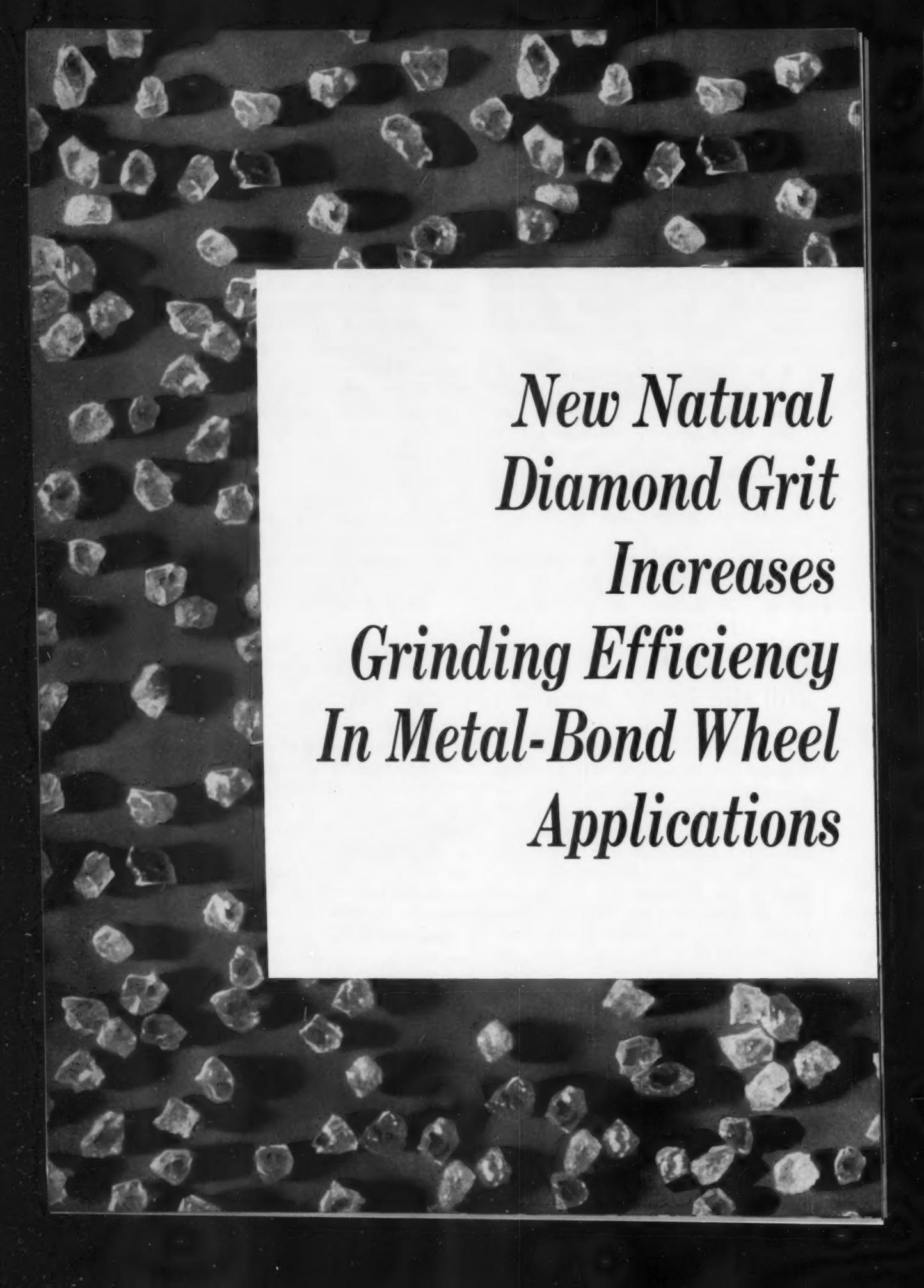
We're not unhappy about the fact that for years, in many plants, the name New Britain has been synonymous with chuckers. New Britain Chuckers have turned out literally millions of pieces of work for practically every major industry in the world. This is less important to the prospective buyer of one of these machines, however, than the capabilities of these machines today. How do they stack up against other chuckers or even other types of machines capable of doing similar work? Pretty well, we think.

New Britain's open-end design still can't be beat for unlimited accessibility to the tooling area. This same wide-open feature makes it doubly more practical to adapt these machines to automatic loading and unloading.

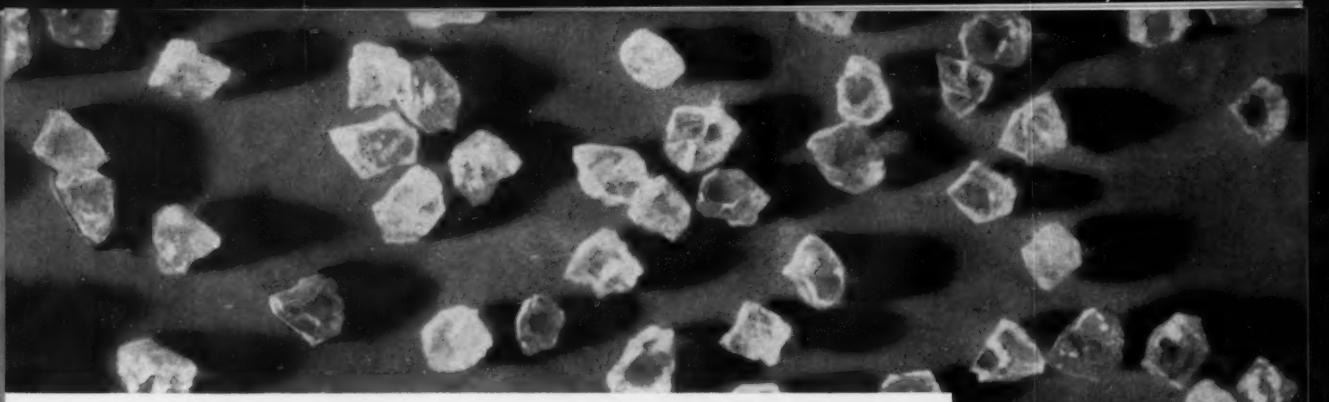
The unusual combination of longitudinal and transverse forming motions is another unbeatable New Britain feature. The massive forming arms

on New Britain Chuckers allow heavier cuts and cuts of much greater complexity. This ability to do more work can eliminate the need for second operation machines in many instances. For really complex work, two chuckers set up side by side, as shown here, each doing one side of the piece, can smooth the way for high production. Less complicated work can be set up to perform both sides of the same piece on a single machine.

These massive machines provide the tooling combinations, spindle speeds and power to perform the widest possible variety of work. Their basic design will stay new for years to come, continuing to provide profitable operation. You may know New Britain Chuckers, but you may not be fully aware of the improved series presently being offered. Why not call your New Britain Representative or contact us at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



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SND-MB (Blocky) is available in mesh sizes ranging from 16/20 to 325/400. Larger sizes are used in heavy-duty applications such as concrete and stone cutting. Smaller sizes are used in metal-bond wheels for grinding and cutting such materials as glass, ceramics, and reinforced plastics.

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- **Two-Way Deterrent to Growth**
- **Half Obsolete, NAM Finds**
- **Industry Members Speak**
- **Ways and Means Chairman Comments**



## Keeping up with Washington

Loring F. Overman

MACHINE TOOL COMPANIES should be among the chief beneficiaries if success rewards a tax-revision drive being readied for the Eighty-Seventh Congress when it convenes in January. Business appears to have reached a decision that the time has come to convince Congress that the present tax structure is braking industrial expansion and curtailing gross national product totals. The Machinery and Allied Products Institute, through numerous published studies of depreciation practices, has done much spadework leading up to the present movement.

The National Machine Tool Builders' Association has been equally active in encouraging a review of factors which NMTBA believes have interfered with timely replacement of machine tools, and with installation of the automated systems which would speed production and reduce manufacturing costs.

### Two-Way Deterrent to Growth

There is growing evidence that MAPI and NMTBA are no longer working alone in the interest of revising business tax schedules. The National Association of Manufacturers, in a statement directed to the Joint Economic Committee, observes that current tax rates comprise a two-way deterrent to growth.

NAM president Rudolph F. Bannow, also president of Bridgeport Machines, Inc., observed:

"Under present laws the excessive rates applied to the sources of investment capital are a serious deterrent to growth in two ways. In the first place the present high rates reduce the actual amount of capital available for investment. Secondly and equally important, the realization that any gains earned through investment will be subject to very high tax rates seriously reduces the incentive to invest."

### Two-Way Deterrent to Growth

In another NAM statement, Keith R. Miller, the Association's general manager, explained:

"It is estimated that about half of America's productive facilities today are obsolete or nearly so, and that only about 10 per cent of those in European industrial nations are in such condition. How did forward-looking progressive American industry get into such a position? The answer is that our present tax system has drained away the money that should have been invested to keep us ahead."

Mr. Miller encouraged business and the public to urge Congress to enact the Herlong-Baker bill, or its equivalent, stating: "The bill calls for a reduction over five years of personal tax rates from the basic 20 per cent now in effect down to 15, and the basic 52 per cent corporation tax down to 47, with other rates adjusted accordingly. This would allow faster depreciation write-off and lead to new business and better job opportunities."

### Industry Members Speak

In addition to the viewpoints of machinery and manufacturing associations, the Joint Economic Committee received many statements from individual manufacturers and from users of machinery. These have been included in a 602-page report, "New Views on Automation."

Ralph E. Cross, Detroit, said that it takes from twelve to thirty years to recover capital invested in machine tools in the United States, compared with four to eight years in European industrial countries. "Congress," he said, "should take immediate steps to liberalize current Internal Revenue Service depreciation practices, which are restricting new capital investment and the creation of new jobs."

Alan C. Mattison, Mattison Machine Works, Rockford, Ill., pointed out that "nearly everybody, including the Treasury, realizes that we have to discard our outmoded depreciation and replacement practices if we are to modernize our plants, reduce our costs, and compete effectively." He indicated that machine tool advancements are coming so fast that many forward-looking managers find it necessary to replace their machine tools every five years to remain competitive.

A two-year obsolescence period was suggested by Cleo Brunetti, president, Grand Central Rocket Co., Redlands, Calif. "For modern machines," he said, "a two-year obsolescence period is pretty much the rule. Of course there are many examples of machines that continue to function for many years. The newer type of machines, however, are more complex and costly."

Further evidence that the need for liberalization of depreciation schedules is widespread comes from the American Economic Foundation. After polling business and labor economists, the Foundation noted that seven out of nine favor liberalization. The Foundation's report also quotes similar viewpoints from individuals within every branch of the Federal Government.

### Ways and Means Chairman Comments

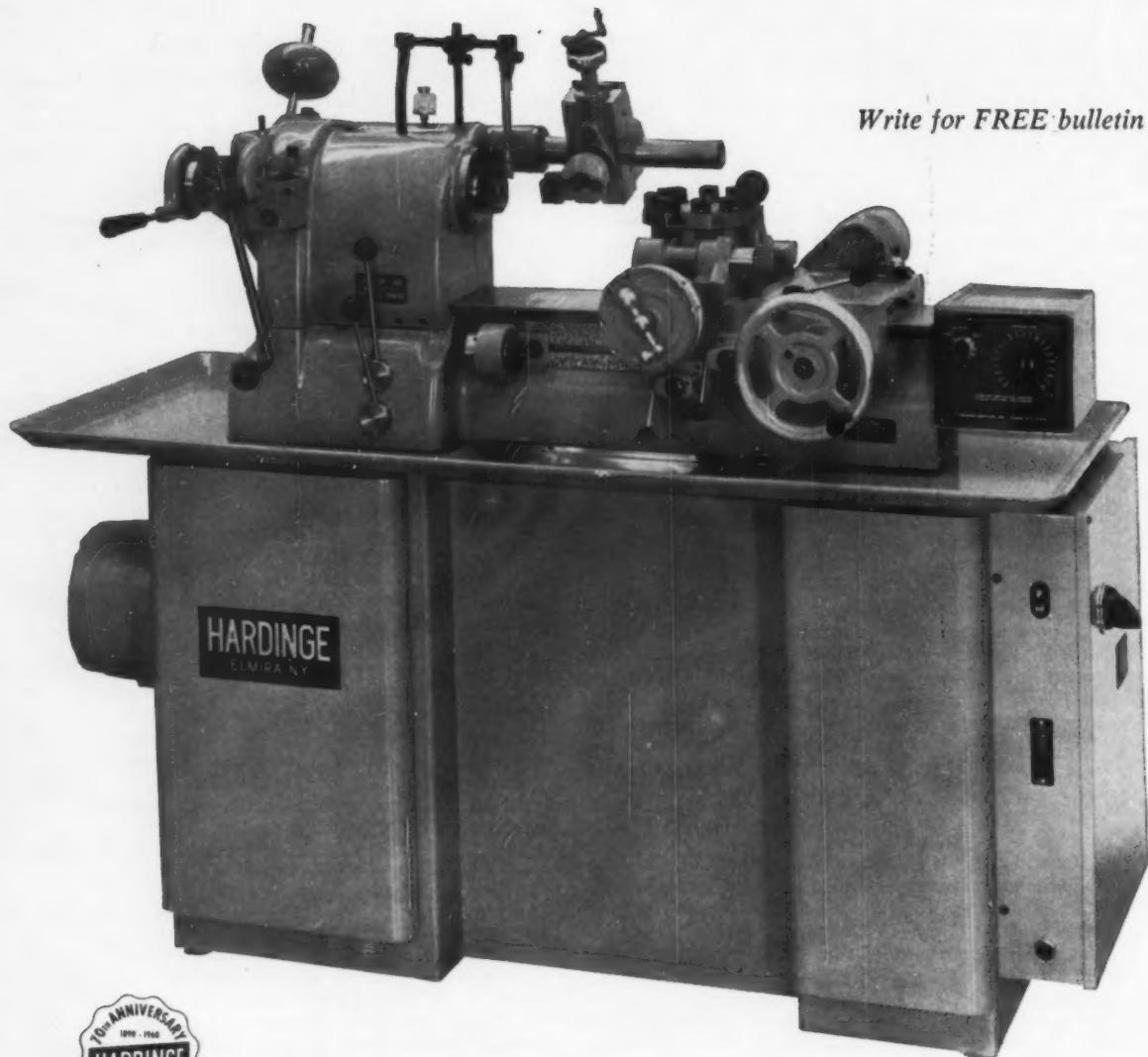
Probably the most encouraging comment on the possibility of a tax schedule revision comes from Chairman Wilbur D. Mills (D-Ark.), chairman of the House Ways and Means Committee. Following a review of a "Tax Revision Compendium" prepared by 178 authors in 31 different panels, Chairman Mills stated:

"It is certainly my thought that our tax rates are much too high from the standpoint of incentive and economic growth. I hope that as a result of these hearings and their analysis by the staffs, we will be able to find some means for making an adjustment in the tax rates through revision of the tax base, while at the same time keeping the level of revenue collection sufficient to meet essential expenditure requirements."

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## The New Secretary of Commerce Should Strongly Represent Industry



THE PROBLEMS OF BUSINESS are multiplying! Not only must our industrial executives meet the increasing challenge of low-priced imports, but they are being exhorted to expand the exportation of their products to foreign countries.

In his last message to Congress, President Eisenhower pointed out that a continued rising volume of exports is essential to the prosperity of the United States. The Department of Commerce is publicizing information to the effect that export opportunities which did not exist a short time ago have been brought about by changes in world conditions, the business boom in Western Europe, liberalized government controls, and the growth of new nations.

The department has organized an export expansion program which is intended to assist companies in promoting their business abroad. Thirty-three field officers are stepping up their services toward this end.

This is all well and good, but industry's main problem is to manufacture at costs sufficiently low to meet foreign competition both at home and abroad. With our high labor costs, this is an objective difficult to attain.

There should definitely be a tax incentive to replace our obsolete machinery with modern high-production equipment. More liberal depreciation rates on capital goods are also necessary in order to make plant rehabilitation economically feasible.

The fact of the matter is that in many industries foreign plants are as modern as ours and in some cases superior. This state of affairs exists in considerable part because American industry cannot improve its plants at the same pace as foreign manufacturers, due to our unrealistic depreciation policies.

Many businessmen feel that industry has been neglected in recent years in official Washington circles because its problems have not been emphasized. To bring industry's problems into proper perspective on the political scene should be a primary purpose of the Secretary of Commerce appointed by President-elect John F. Kennedy.

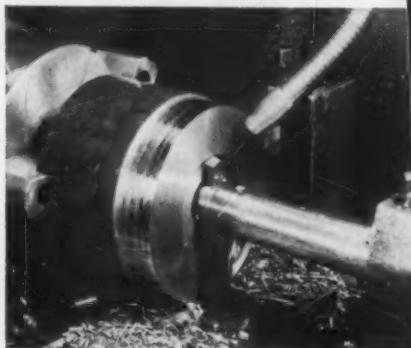
The new secretary should be forceful enough to see that business is not left on the sidelines in controversies, but rather that it be recognized as being most important to the success of the national economy.

*Charles O. Herb*

EDITOR



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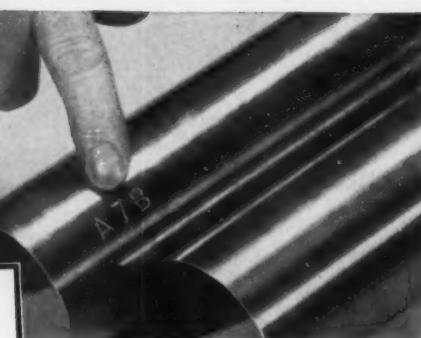
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Medium Carbon Annealed	4140 4140 leaded 4147 4147/50 leaded
Direct Hardening	4340 E6150 8647 leaded

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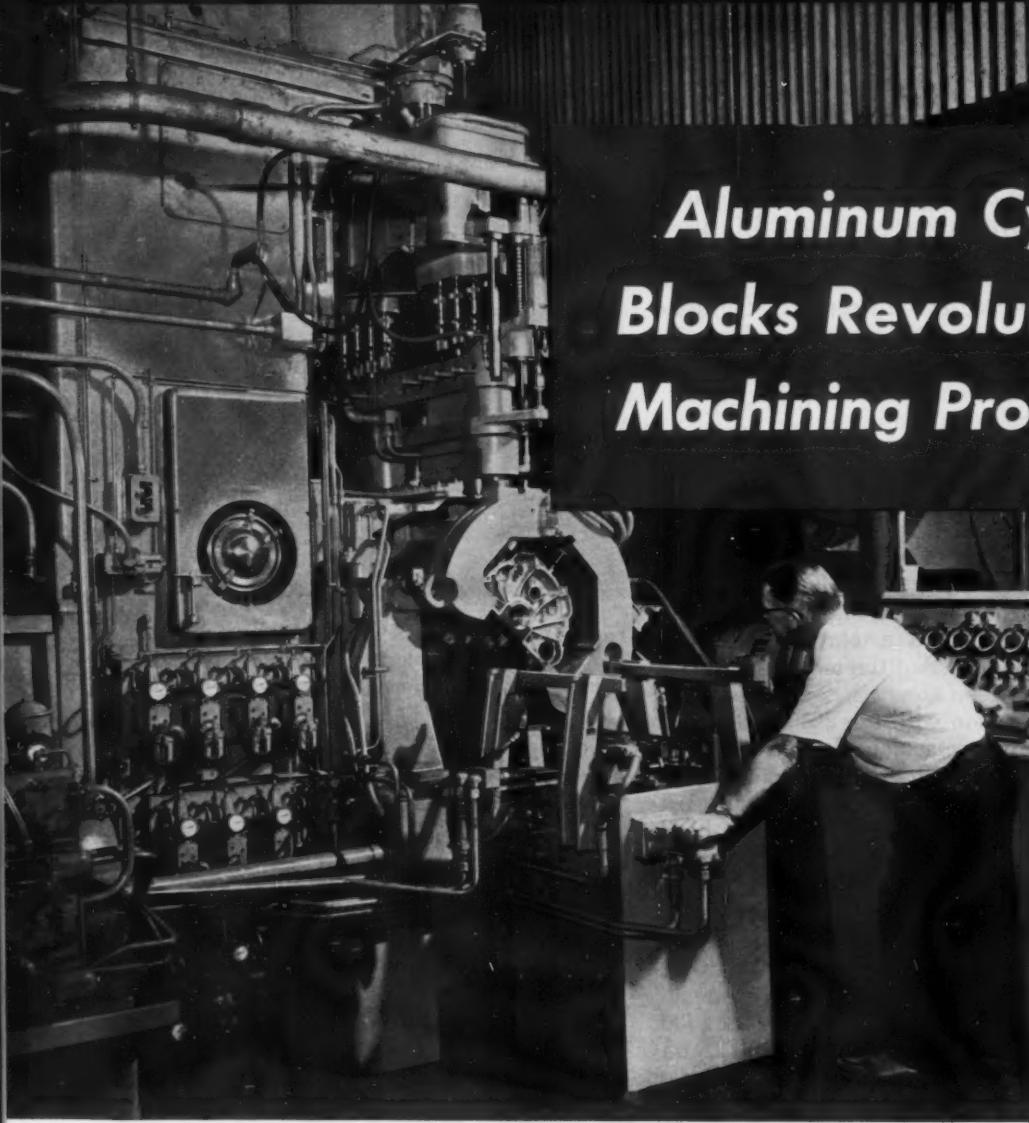
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## Aluminum Cylinder Blocks Revolutionize Machining Procedure

LAURENCE W. COLLINS, Jr.  
Associate Editor

**After sixty years of working cast iron, Buick is building an aluminum engine. The change-over is as full of problems as it is dramatic. Broaching is all but absent, speeds and feeds are double or triple. Where coolant was formerly unnecessary, it is now used in large volume**

UP UNTIL the 1961 Buick and Oldsmobile small models came on the market the only car with a water-cooled aluminum engine has been the Rolls-Royce. Despite the continued success of this famous British luxury car, automotive engineers have been divided in their opinion as to whether aluminum is practical for a water-cooled block. Apparently Buick and General Motors have taken the attitude that "if it's good enough for Rolls-Royce, it ought to be good enough for our engine crank cases."

The introduction of this V-8, 215-cubic-inch displacement engine, called the 4100 (Fig. 1), into Buick's production line has proved an interesting change-over, with many departures from the practices used for sixty years on cast-iron engines. The company had gained some inkling of the problems it would confront when it retooled

a line for manufacturing an aluminum transmission case.

The crankcase of the 4100 engine is aluminum with cast-iron cylinder sleeves molded in place at GM's Alliance, Ohio, foundry. A combination mold—part sand and part permanent mold—is used. The water jackets are cored in the usual fashion. Composition of the aluminum alloy is:

Silicon	6.5 to 7.5 per cent
Copper	9.25 max.
Magnesium	0.20 to 0.40
Iron	0.6
Manganese	0.35 max.
Zinc	0.35 max.
Titanium	0.25 max.
All other	0.15 max.

The 4100 engine delivers slightly more than 155 hp at 4800 rpm. With a total weight of 305 pounds, it can be seen that the engine delivers a little more than 1 hp for each 2 pounds of its weight. A comparison with the 225-hp standard cast-iron engine is spectacular. The 1960 cast-iron engine weighs 575 pounds. The aluminum crankcase weighs 62 pounds as compared with 194 pounds for cast iron. An aluminum cylinder-head casting weighs 15 pounds as against 85 pounds for cast iron.

One of the most noticeable differences in the shift from cast iron to the aluminum block is the absence of broaching in manufacturing. The aluminum block is milled by a transfer machine on the pan rails and starter pads at speeds of 1500 to 2000 sfm, Fig. 2. Surface speed of milling on the bank faces must be a compromise because the cutters slash right across areas where the cast-iron cylinder sleeves are flush with the aluminum surface. Speed is cut to 1200 sfm for the combination cut.

Broaching cannot be used on aluminum crankcase castings because pressures of clamping and also the cutting forces are great enough to distort or crush the castings. High-surface-speed face milling, on the other hand, is nearly as fast as broaching. The method requires comparatively small clamping pressures, and the aluminum castings have the compressive strength to resist the cutting forces of milling. Carbide-tipped milling cutters are used throughout. These have special bodies and special grinds.

For aluminum, Buick grinds milling cutters with drastic 6- to 8-degree hook angles on edges and side rakes, and uses 15 to 20 degrees on other cutter angles, Fig. 3. Cutters used on combinations of cast iron and aluminum, such as the bank faces, have alternately ground teeth (one with cast-iron geometry, the next ground for aluminum). Zero rakes are used on interrupted cuts. Cutting bits are hard grades of tungsten carbide

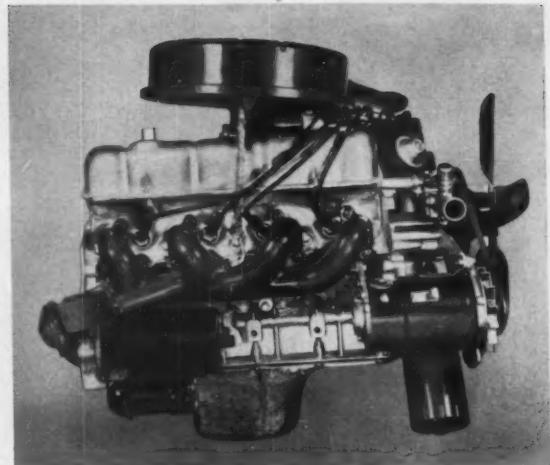


Fig. 1. Engine for Buick's small Special Series has an aluminum cylinder block as well as aluminum for cylinder heads, intake manifold, pan, valve-head covers, and front-end housings.



for the heavy chip loads. All cutter surfaces that come in contact with aluminum chips are lapped with 500-mesh diamond to give a profilometer reading of 4 to 6 micro-inches. The reason for the extremely smooth surface is to prevent welding of chips. The only scratches that can be tolerated are those running across the face of a given cutter tooth or blade.

The milling cutter bodies are specially designed for extra chip clearance, as at the extreme right in Fig. 2, and are unusually "clean" wherever chips may strike. By the term clean is meant that there are no cavities or projections where chips can lodge or stick. Surfaces are polished. Cutter speeds and chip loading are so high that chips come off in a veritable stream in a plastic state. If there is any lodging of chips in the cutter

body the stream of chips from the cut instantaneously snowballs by welding to the lodged chip. In a few seconds the mass of chips builds up large enough to stop the machine spindle head or else break the cutter body.

The taps used for threading bolt holes are a special Turbo-Cut design by Threadwell Tap & Die Co., Greenfield, Mass., with ground spiral flutes, Fig. 4. The relatively tight helix has the same effect in tapping as increasing the rake has in other cutter blades. The highly polished flutes are unusually deep to expedite the passage of chips during threading.

At three different places on the line powerful tunnel style washing systems have been placed. The crankcases are blasted with 6-per-cent Elray soluble-oil emulsion to remove machining chips that lodge and adhere to the cases.

Drilling, especially for the two oil-gallery holes, has required special tools. These two holes run the entire length of the crankcase. Gun drills have not proved fast enough and tool life is comparatively short. To counter these two limiting factors Buick uses a new tool called a tube drill, Fig. 5, made by Detroit Reamer & Tool Co., Birmingham, Mich. These 0.4375-inch Bi-Tip drills are designed specially for deep holes in aluminum. They have high-speed, replaceable two-flute tips, drilled at the point for constant high-pressure coolant delivery to the lips at 40 psi. After about one twist up the highly polished shank one flute ends and the drill becomes single flute for maximum chip clearance.

The single-twist portion has a steep helix to aid chip ejection. Drill speed is 3500 rpm. The cutting lips are ground concave in a special Royal Oak form-relieving fixture, Fig. 6. The front edge is relief-ground. The chip thus formed breaks off in most cases for easy travel up the flute in small flakes.

Some of these drills are 19 inches long. The oil-gallery drilling machine is a W. F. & John Barnes transfer unit rebuilt for the 4100 engine, Fig. 7. For this operation the crankcase is oriented crosswise on the transfer line so that both ends can be drilled at once. In addition to the deep-hole drills, several shallower holes are drilled simultaneously by the multiple-spindle head. Because the opposing oil-gallery holes meet in the center of the block, the feeds are timed so that one head drills to its maximum depth and begins to retract before the opposing drill head reaches the break-through. During the return stroke of both drill heads the spindles stop. The rapidly spinning drills are so long that whipping may

occur to break them when they are turning unsupported at full speed.

Cast-iron engine components for Buick have been machined dry for sixty years. But on the aluminum block the use of soluble-oil emulsion has been essential to overcome the problem of the sticking and welding of aluminum chips to the cutter bits and bodies, to cool and lubricate the work and the tools, to prevent rusting of the machines, and to improve finish. Antifriction ball-bearing manufacturers, in order to prevent rusting of finished raceway surfaces, commonly use concentrations of 3 per cent in the summer humidity season to prevent rust and 2 per cent in winter. In order to prevent chips from sticking to tools Buick uses a proportion of 6-per-cent soluble oil throughout the whole line, Fig. 8. This high concentration may seem extravagant. However, the performance of the crankcase line justifies the investment by eliminating dangerous chip build-ups, as well as in improving the finish of the work surfaces.

While the use of the soluble-oil emulsion proved beneficial in preventing the build-up of chips, its introduction was not without side effects on the crankcase line which, it should be noted, is for the most part converted from equip-

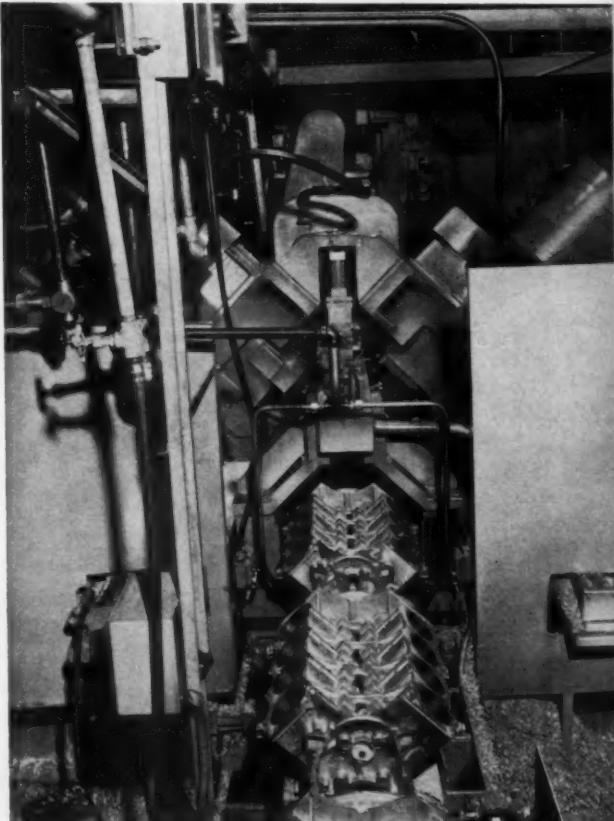


Fig. 2. Aluminum crankcases have bank faces milled instead of broached.

Fig. 3. Milling cutters for aluminum have carbide bits with hook-ground teeth. Broach at top is the only one used. It finish-sizes main bearing cap seats on the face and ends.

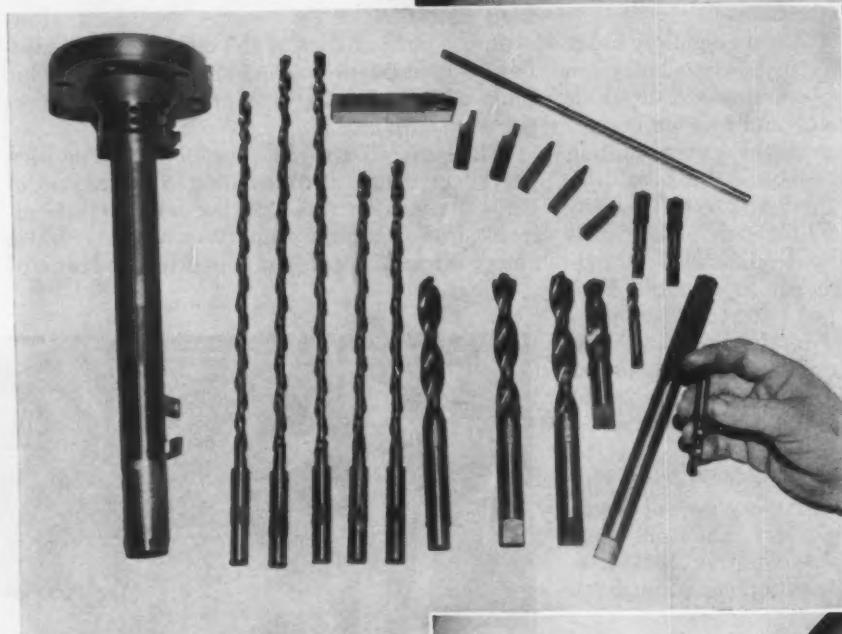
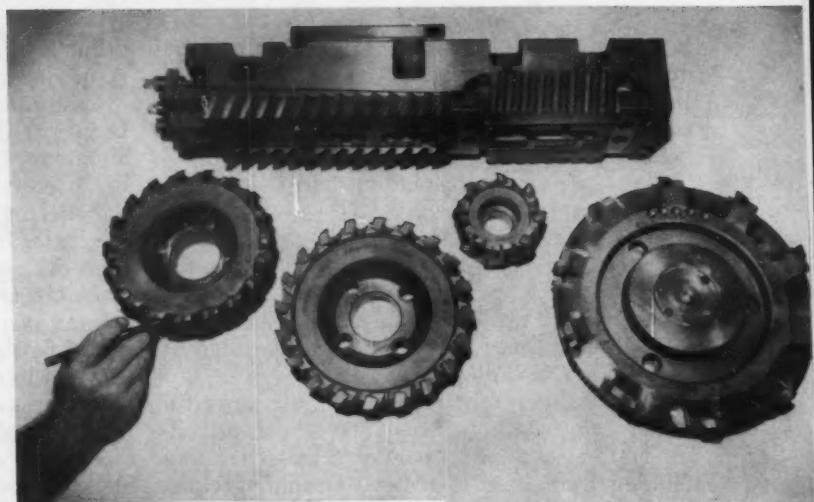


Fig. 4. Special single-point tools used in the aluminum crankcase. At the left center are the oil-gallery-hole tube drills, and at the right the operator's hand holds a special tap with deep spiral flutes to increase rake.

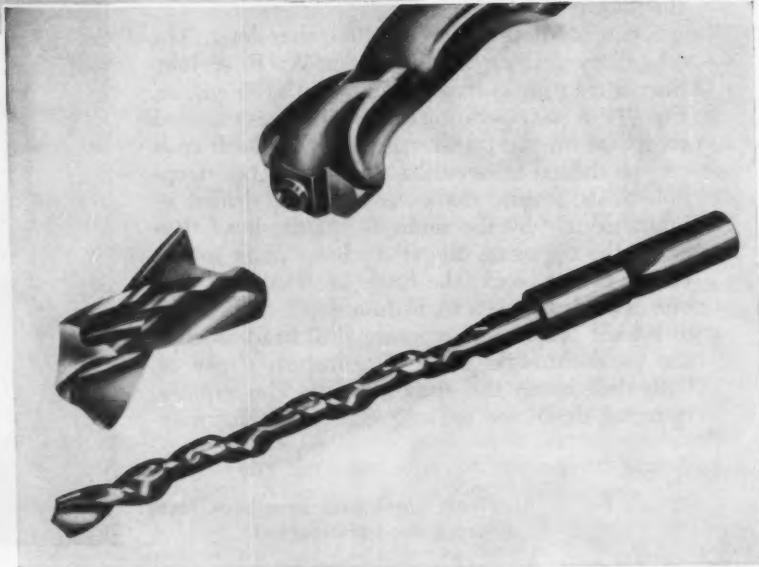


Fig. 5. Close-up of single-flute Bi-Tip tube drills for the oil-gallery holes. The throw-away, high-speed tip is brazed to the shank and the coolant supply duct is oversize for greater flow.

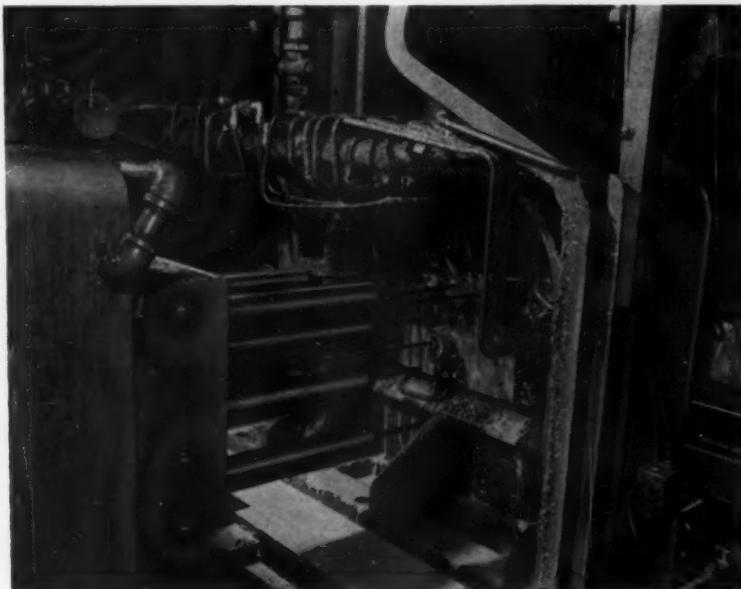


**Fig. 6. Special form-relieving fixture on drill grinder makes cutting lip profile concave; slims center web spade for straighter, faster cut. Concave lip curls chips, makes them break easily.**

ment formerly used on cast iron. Precision switches, relays, and other electrical gear required no special protection for cast iron because it was machined dry. But when the aluminum started down the line and the soluble-oil emulsion, aided by high pressure and high cutter speed, began to splash and spray, the electrical interlocks got wet and began to malfunction. Some could be moved out of the spray, some were shielded, and others had to be waterproofed to eliminate the source of difficulty, Fig. 9. The problem was complicated by the necessity of using relatively high pressures to dislodge chips. Hence the spray affected an unusually wide area and thus made protection of wiring and components a general problem.

The conversion of capitalized transfer equipment plus new equipment for the 4100 aluminum engine represents an investment of about \$13,500,000. Of this approximately \$6,000,000 was spent on the transfer line for the crankcase line. Buick engineers comment that out of fourteen major machining units in the engine-block line only three are new, the Natco main bearing oil-seal groover, Fig. 10, the pan-rail rough mill, Fig. 1, and the final cylinder-bore lapping machine by Barnes Drill Co., (heading illustration). The remainder of the equipment was "hand-me-down," retooled or rebuilt for this aluminum engine. Three high-pressure washing machines with an extra-size central reservoir are placed at necessary stations to remove chips.

**Fig. 7. Both crankcase ends are drilled with multiple heads in this rebuilt W. F. & John Barnes unit. The two long drills are the 19-inch tube drills for the oil-gallery holes. Note the liberal coolant supply, even in back of the bushing plate. Speed is three times faster than for cast iron.**



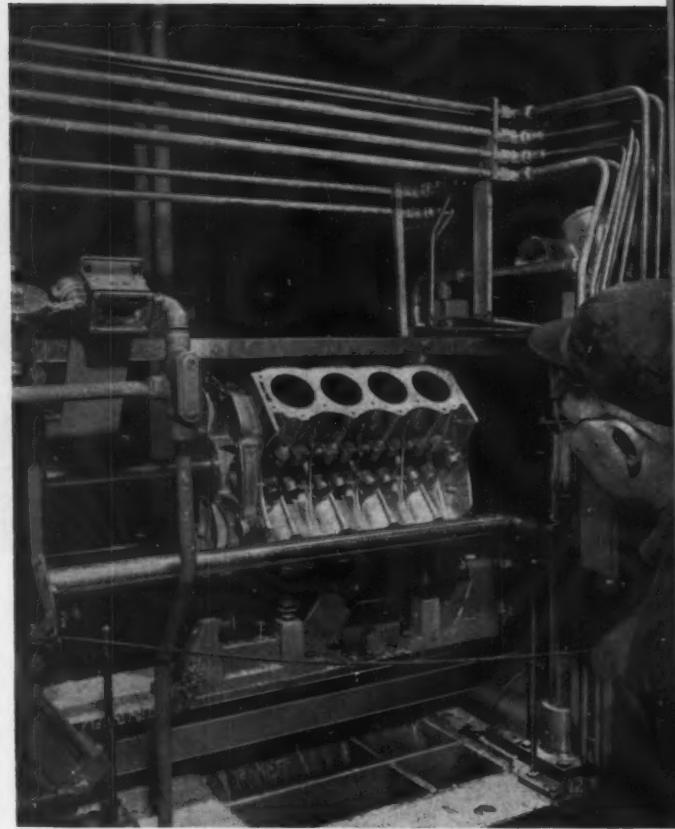
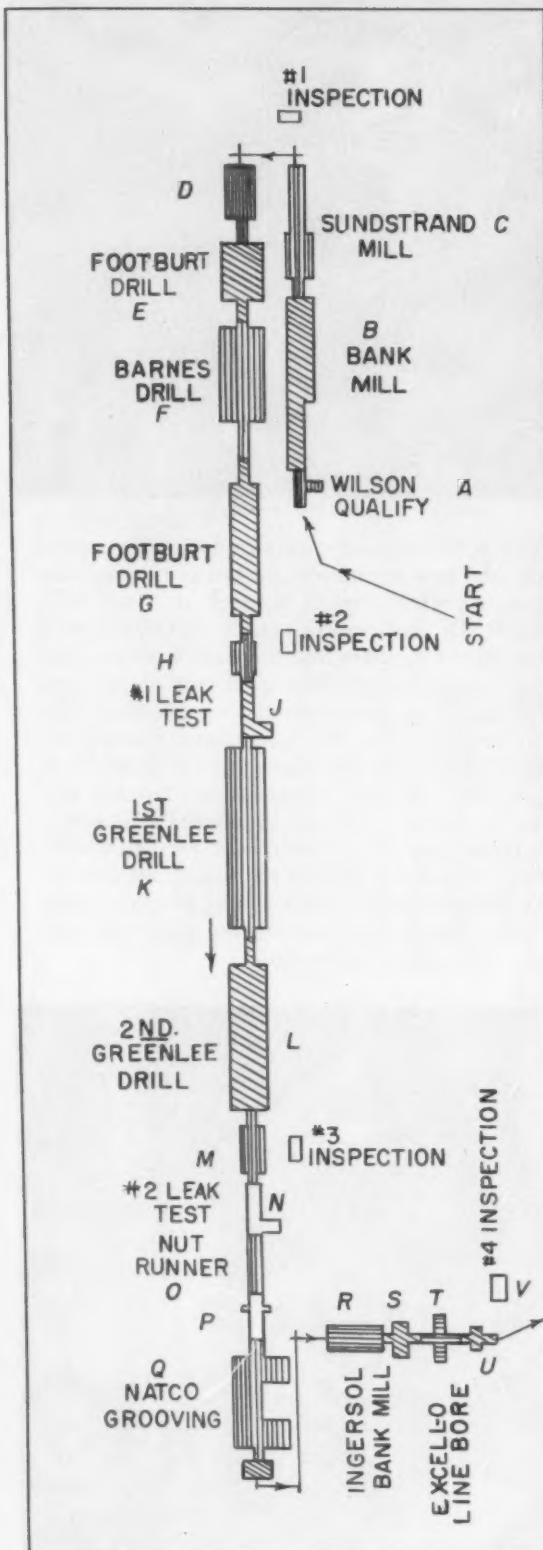


Fig. 9. Water proofed precision switch (upper left) shows effect of coolant in change-over of this Foot-Burt transfer machine for line-boring main crank bearings of 4100 crankcase.

Fig. 8. Crankcase machining line converted to aluminum shows major transfer machines. Units A, B, Q, and X are the only new ones.

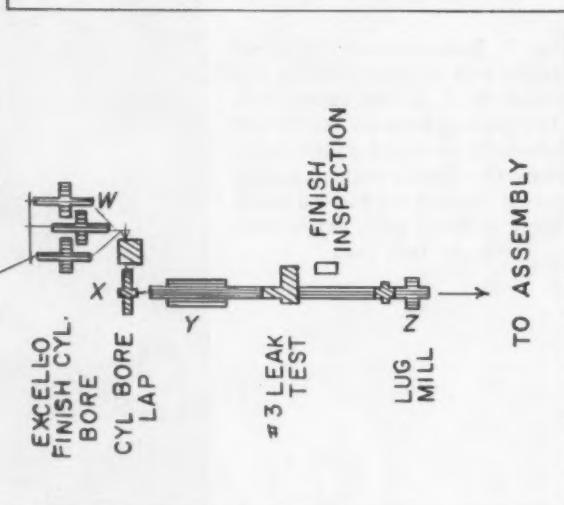


Fig. 10. Grooving of the rear main bearing is done by the new Natco machine on the left. Five babbitt camshaft bearing inserts are pressed in place by a special press built by Detroit Broach & Machine Co., on the right.



Representative of the trend in the automotive and other mass-production industries, rebuilt machine tools are playing an important part in the manufacture of the 4100 engine for the 1961 Buick Special. The same holds true for the entire automobile. In the case of the 4100 crankcase line, to have toolied up with completely new transfer machines for the whole line would have cost somewhere between 40 and 45 per cent more. Existing machines with much unused productivity in them were retooled and put back to work, Figs. 7, 8, 10, 11, 12, and 13.

Chip handling for the aluminum crankcase line proved more of a problem than with cast iron. Chips from the latter crumble. But the

chips from aluminum are ductile and, even though chip-breakers are used wherever possible—as in the case of drills—long, feathery chips are sometimes inevitable. The roughing cuts at high surface speeds, Fig. 2, fill the air with a blizzard of chips, requiring several different attempts at effective shielding. A further problem is created by the fact that in some of the cuts—the bank faces, for example—the chips are bound to be a mixture of cast iron and aluminum. Therefore a by-product of the plant is three different kinds of swarf—cast iron, aluminum, and a mixture of the two. The three kinds of chips must be collected, accumulated, and handled separately for return to the foundry.



Fig. 11. Rough boring of cast-iron cylinder liners is part of machining done by this Moline transfer miller, which was rebuilt for the 4100 case line by Sundstrand.

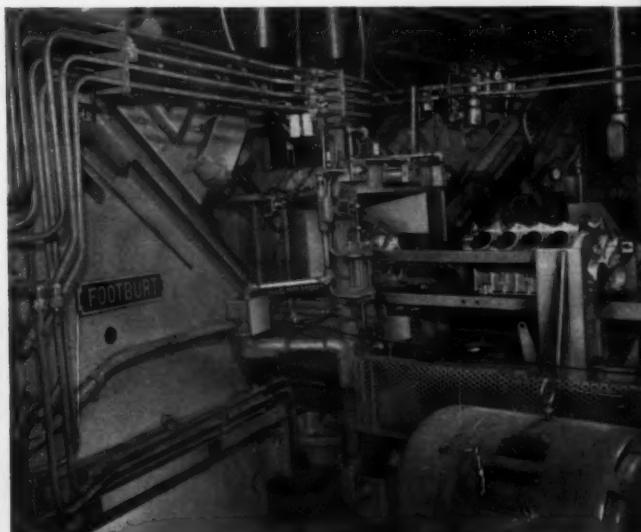


Fig. 12. Valve-guide-bushing holes are drilled by this converted Foote-Burt transfer unit. Note the heavily shielded conduits that waterproof the electric wiring.

A great many of the finishing operations on the block line are typical of cast-iron operations. Line boring of the crankshaft main bearings, Fig. 13, is relatively unchanged. An ingenious new Detroit Broach & Machine Co. machine makes insertion of the five babbitt bushings in the cam-shaft holes semiautomatic (Fig. 9, right). The new Natco machine (Fig. 9, left) core-drills the camshaft bearings preparatory to putting in the babbitt inserts. This same machine roughs the front-end oil-seal and slinger grooves for the crankshaft. A special Scully-Jones recessing tool opens in the cut. Depth of cut is maintained by a positive stop. A back cylinder of the machine takes over to feed the cutters outward in the undercuts. The next station semifinishes the oil-seal and slinger grooves and finishes the center thrust bearing seat.

Another of the new machines is the finish-bore lapping machine (heading illustration). This Barnes Drill Co. unit has all head spindles vertical, instead of inclined, to improve roundness. The crankcases enter the machine on the walking beam type conveyor. Here they are clamped on an orienting carriage which tilts the cylinder

blocks so that one bank of bores aligns with the first set of four lapping spindles. A transfer next carries the first block to a second carriage which presents the second bank of bores to the second set of four lapping heads. The cast-iron surface has a finish of 25 to 40 micro-inches.

The main bearing caps are cast iron. These are bolted in place on the aluminum seats, and an Ex-Cell-O machine using specially ground cutters, Fig. 13, aligns the main bearing holes in the conventional fashion preparatory to putting in the usual babbitt inserts.

Provision is made throughout the engine design to avoid contact of radiator water at any aluminum-to-ferrous-metal interface, where it might cause accelerated galvanic corrosion.

When the finished 4100 engine crankcases leave the positioning lug cutoff mill, the last operation, they move directly to assembly line fixtures. During engine assembly the new blocks move down, the line mixed indiscriminately with traditional cast-iron crankcases. Consequently no special provisions have to be made for handling the aluminum blocks or parts from this point onward in the assembly line.

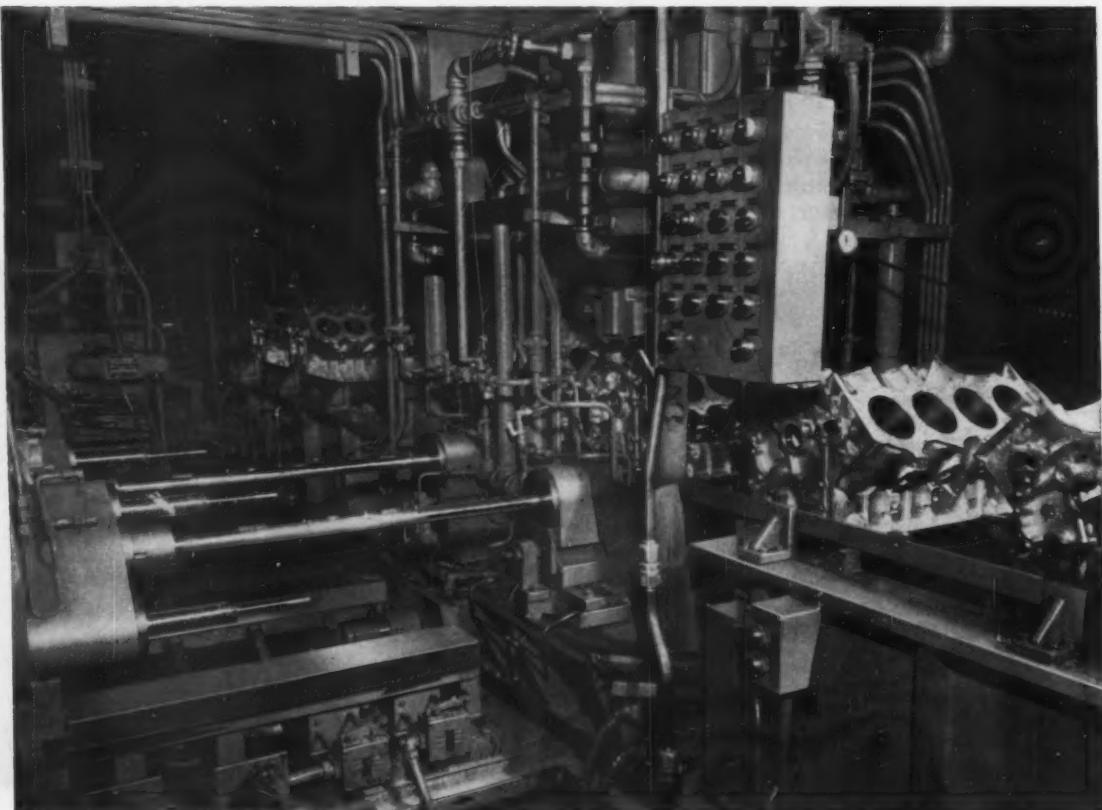


Fig. 13. Special grind on cutting bits line-bores camshaft bearing seats in this Ex-Cell-O machine formerly used on cast iron.

# INERT-GAS TUNGSTEN-ARC SPOT WELDING IN MISSILE PRODUCTION

**Results of a project undertaken by the manufacturing development department of Convair (Astronautics) Division of General Dynamics Corporation, San Diego, Calif., to determine the possibility of using tungsten inert-gas spot welding as a tool for repairing leaks in or around resistance spot welds on the Atlas missile**

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Tool Development Engineer  
Convair (Astronautics) Division  
General Dynamics Corporation

TUNGSTEN INERT-GAS spot welding has been applied successfully in the welding of the Atlas missile when proper operating procedures and operator techniques have been followed. In the investigation conducted by Astronautics to determine the possibilities of the process in the intended application, the capacity of the equipment was limited to total combination gage thicknesses between 0.020 and 0.100 inch. It was found that the ratio of the thickness of the two outside pieces to be welded imposes a limitation where different thicknesses are welded because of the fact that the weld is made from one side only.

The scope of the tungsten inert-gas spot-welding process is extensive as to adaptability. Because welding is accomplished from one side only, numerous applications are possible that are not readily adaptable to other welding processes. Consistency, reliability, and reproducibility were comparable to resistance welding in the phases tested.

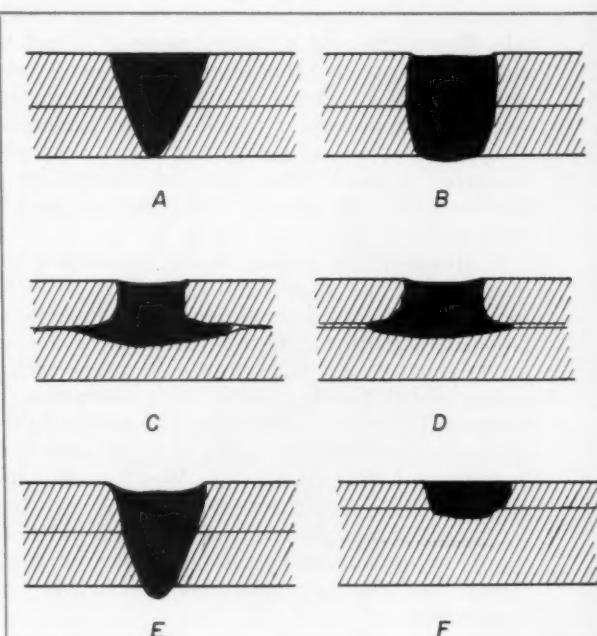
In order to determine the capabilities and versatility of tungsten inert-gas spot welding, it was decided that all gages of metal and combinations of gages used on the tank sections of the missile be welded as a test. There are a total of 138 combinations.

## Variable Factors

It was determined by these tests that current amperage, arc length, cycles, gas coverage and flow, electrode type and preparation, base-metal preparation, contact of faying surfaces, and various backup materials were variable factors which required accurate control. Also that the correct

amperage is determined by the gage and condition of the material to be welded, length of weld time or cycle, electrode type and preparation, and type and amount of gas coverage. An arc length of 1/16 inch preset by the welding machine manufacturer was found to be satisfactory. The cycles were determined by the gage and condition of the material to be welded, amount of heat or amperage, electrode type and preparation, and type and amount of gas coverage.

In gas coverage and flow tests two inert gases, helium and argon, were used. Less heat, or amperage, was required for a good weld when helium was used. A flow of about 10 cubic feet per hour gave the best coverage. Higher flow would force the molten puddle through the base-



**Fig. 1. Penetration of weld under various conditions, such as different electrode points and welding pressures.**

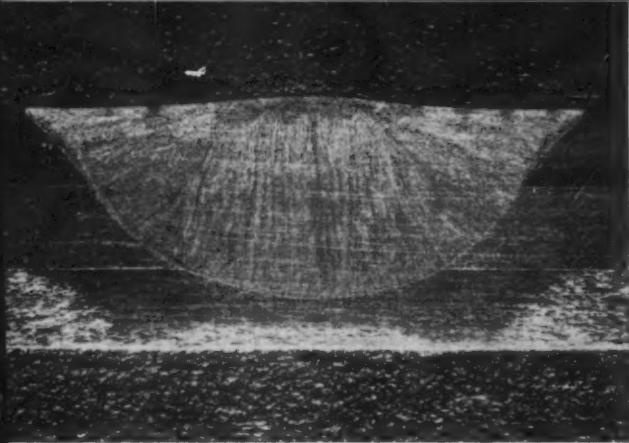


Fig. 2. Photomicrograph of cross section through three metal sheets joined by inert-gas tungsten-arc spot welding.

plate, while lower flow would not afford sufficient coverage to protect the weld from oxidation. Mixtures of argon and helium were not used, because proper facilities were not available to enable experimentation with mixtures. This phase of the investigation was considered most important as proper gas coverage plays a definite role in successful welding of stainless steel. It also protects the tungsten electrode from oxidizing.

In preparing tungsten electrodes for welding, the size may be varied from the full diameter to a ground needle point. By varying the diameter of the electrode end and holding everything else constant, it was found that varying degrees of penetration and nugget diameter were obtained. The chart here presented shows the electrode diameters versus shear strengths when using a constant weld schedule.

The test procedure given in the accompanying table was followed. The type and condition of the material is given along with the weld schedule. Electrodes used in the test were 3/32 inch in diameter, 2-per-cent thoriated tungsten, and were graduated in increments of 0.010 inch beginning with a point and ending with the full diameter. One spot weld was made with each electrode diameter on each gage of metal, except for a thickness of 0.036 inch on which five spot welds were made.

A study of the graphs in the accompanying chart shows that gages from 0.012 through 0.026 inch have constant shear strengths and nugget diameters, regardless of the electrode diameter used. However, a welding arc could not be established on 0.012-inch material with electrodes of 0.080- and 0.093-inch diameters. The most suitable electrode diameters for gages of 0.032 inch and heavier are 0.030 to 0.060 inch. Welds made with electrode diameters from 0.060 to 0.093 inch often produce oval nuggets and have excessive indentation. This is sufficient cause for rejection even though the shear strength and penetration are acceptable.

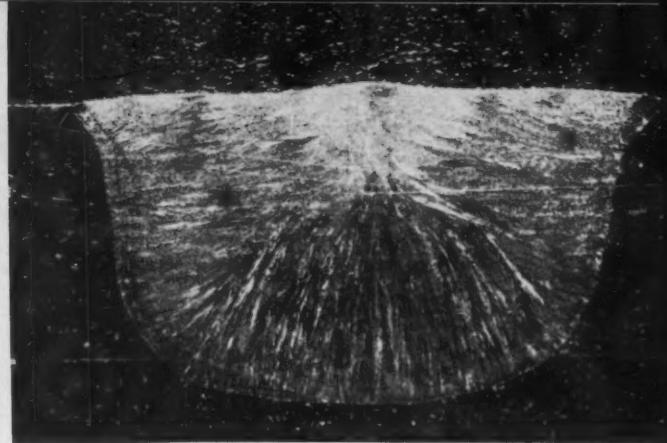
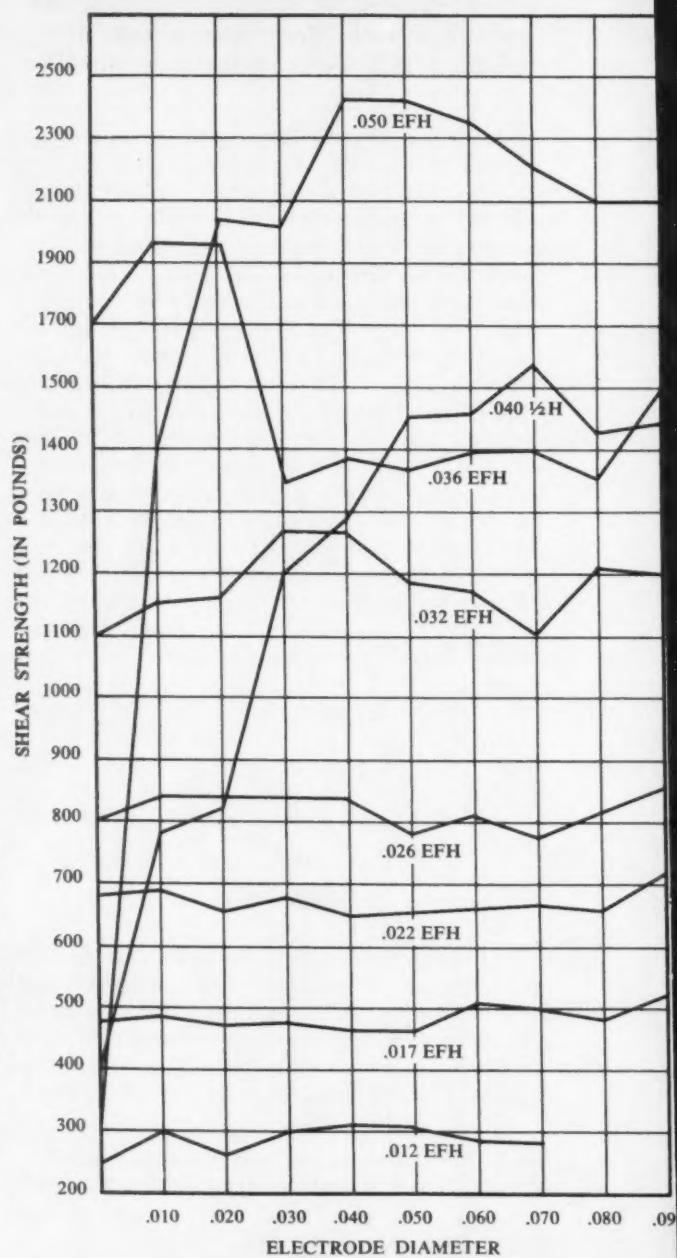


Fig. 3. Cross section through two sheets of stainless steel, one sheet annealed and the other, extra hard.



Penetration through the plates becomes funnelled or cone shaped, as shown at A, Fig. 1. The shape of the penetration when a flat electrode of more nearly full diameter is used is seen at B. The nugget is more cylindrical and constant in size through the plates. A radius on the end of the electrode helps to obtain more consistent welds. It is advisable to re-dress the electrode end when any contamination is noted. Also, when the diameter and radius of the electrode has changed due to burn-off, there is an effect on the weld.

Both inner and outer surfaces of sheets to be welded should be thoroughly cleaned of any foreign matter that would contaminate the weld or hinder arcing. Edges of metal should be burried to assure proper fit of faying surfaces. When welding thin gages (up to 0.014 inch) the heat from the arc causes the bottom sheet to pull away from the top sheet. This causes a nugget to form between the plates, as seen at C, which weakens the weld. Likewise, if too little pressure is applied in welding, the plates will not be flush and a nugget will again be formed between the plates, as shown at D. Because of the absence of pressure, as applied in resistance welding, faying surfaces must be in intimate contact to assure a good weld.

#### Various Backup Materials Used in Experiments

A small amount of development work was done with copper used as a backup material. Consistency with the copper backup was much better than with none at all. Figs. 2 and 3 show photo-

micrographs of some of the welds accomplished by using copper. Aluminum and stainless steel were also used as backup materials, but the results are inconclusive. Inert gases were tried as backup media, and they eliminated the oxidation normally present. The welds were as clean and free from oxide on the back as on the top side of the welded plates.

Fig. 2 shows a cross section through an inert gas tungsten-arc spot weld of a build-up of three thicknesses—0.025, 0.026, and 0.025 inch, respectively—of extra-hard Type 301 stainless steel. The consistency of tensile tests was about plus or minus 5 per cent. Fig. 3 shows a cross section through an inert-gas tungsten-arc spot weld of 0.093-inch annealed Type 321 stainless steel and 0.032-inch extra-hard Type 301 stainless steel.

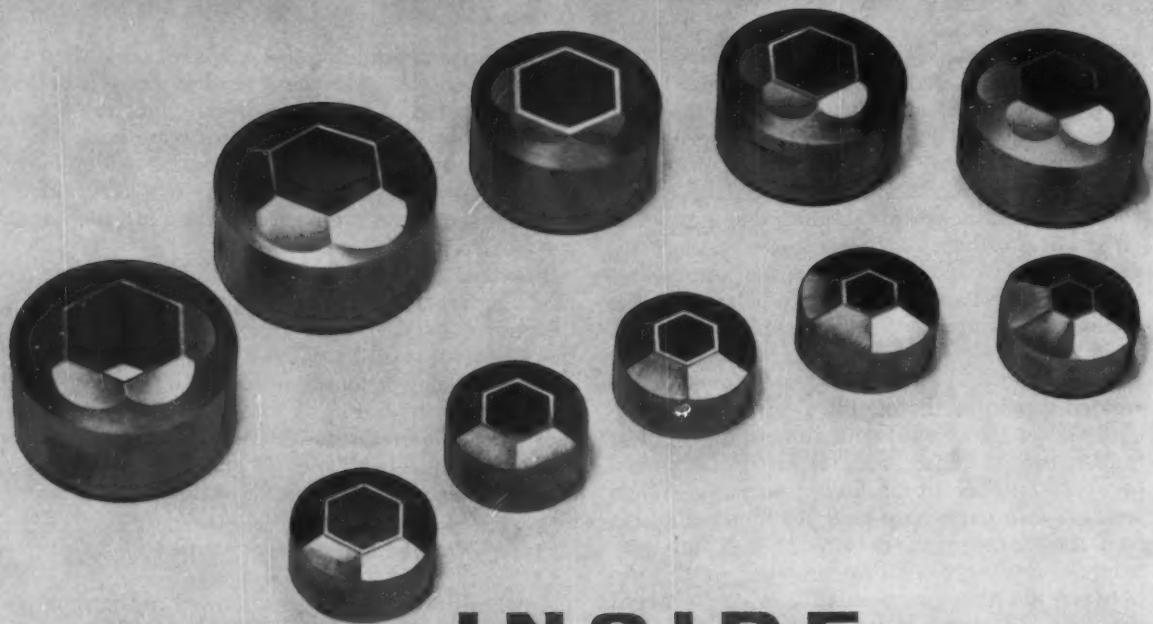
#### Problems and Irregularities

A major difficulty was encountered in the spot welding of nearly similar gages about 0.025 inch thick. The problem lay in obtaining enough penetration to meet the required shear test and yet eliminate excessive drop through as indicated at E in Fig. 1. Little trouble is encountered, however, in welding light gage to heavy gage and vice versa, a condition shown at E.

Copper, "K" Monel, aluminum alloys, brass, titanium, and other types of stainless steel were included in the developmental work, but the results were inconclusive. Most of these materials are weldable to some degree, but additional research is required to determine the quality of the welds and the feasibility of scheduling each material condition and gage.

WELDING SCHEDULE FOR 301 STAINLESS STEEL

Gage of Metal	Condition of Metal	Amperes	Cycles	Gas Cubic Feet per Hour
0.012	EFH	20	10	10 Helium - 3 Argon
0.017	EFH	32	10	10 Helium - 3 Argon
0.022	EFH	48	10	10 Helium - 3 Argon
0.026	EFH	64	12	10 Helium - 3 Argon
0.032	EFH	100	15	10 Helium - 3 Argon
0.036	EFH	140	17	10 Helium - 3 Argon
0.040	1/2H	154	14	10 Helium - 3 Argon
0.050	EFH	185	30	10 Helium - 3 Argon



## INSIDE CHIPLESS MACHINING

**Placed over a mandrel and squeezed from the outside by rapidly pulsating dies, cold tubular blanks of M2 and M3 high-speed tool steels are made to move by metal flow. The Intraform method accurately and rapidly produces complex inside profiles with extremely low-cost tooling; improves hardness, tensile strength, and surface finish to a marked degree**

LAURENCE W. COLLINS, Jr., Associate Editor

PARTS with internal forms other than those made by drilling have always been troublesome in metalworking. The problem becomes amplified when the internal profile becomes complex or the material is of the hard-to-work variety. A good example of the latter is high-speed steel for insert dies (heading illustration) used in boltmaking machinery for trimming the wrenching faces of hex-head cap-screws. Howell Gear Co., Howell, Mich., makes bolthead trimmer-die inserts from M2 and M3 high-speed steel in volume, for a number of different customers.

The company uses Intraforming, a type of chipless machining, to produce the internal form of the inserts. While the cost of the tool steel is an important factor, the reason the Intraform method is used is that it is so fast and inexpensive to tool compared to broaching. Thus, this tool-steel insert application is an example of

the chipless-machining principle, now turned full circle. The original material-saving advantages have now been overshadowed by the method's ability to produce, faster and better, a form on the inside diameter of a cylindrical work-piece. Automatic feeding will deliver 300 parts per hour; manual loading, 150 per hour.

The Intraform process and equipment are relatively new developments of the Meta-Dynamics Division of the Cincinnati Milling Machine Co. The machine at Howell Gear Co. is the first unit to go into full-scale commercial production in the United States. While there is a certain resemblance, the method should not be confused with swaging. In the Intraforming machine, Fig. 1, hollow cylindrical stock is placed over a mandrel, Figs. 2 and 3, which is the reverse of the shape desired for the internal form. The machine uses a set of four forming dies, Fig. 4,

which pulsate rapidly while revolving in contact with the outside diameter of the work-piece. The dies, mounted on cams, are caused to pulsate radially through contact with a series of free-wheeling hardened-steel rollers, tracking a stationary raceway in the machine's headstock, as shown in the illustration.

The camming surface has the form of a sine curve. Because the cams never lose contact with the rollers during the time the dies revolve around the work, the sine-curve form results in a smooth, continuous, pulsating-squeezing action by the dies. There is no hammering, even though the work gets 1000 squeezes per minute. Noise and vibration are absent, in contrast to swaging.

The pressure forces the work-piece to the shape of the mandrel. Contact with the rotating dies causes the part and the mandrel to revolve, but at a speed somewhat slower than that of the dies. At the same time, the work-piece is fed over the mandrel and toward the rear of the headstock. Because the work feeds and the mandrel does not, long work-pieces can be formed

with short, comparatively inexpensive mandrels.

In the case of the high-speed trim-die inserts, the mandrels are M2 or M3 high-speed tool steel, hardened to 60-62 Rockwell C. The Intraform squeezer dies are of similar material.

In its pioneering work with the first operational Intraforming machine, Howell Gear Co. has formed a great many materials in addition to the M2 and M3 tool steels. Some of the resulting parts are shown in Fig. 5. The materials range from high-speed tool steels through various automotive gear and shaft steels. Several Series 300 stainless steels have been successfully formed, as well as such nonferrous materials as aluminum alloys, zirconium, Inconel, Hastelloy, brass, copper, and phosphor bronze. Interesting combinations have been made of steel within brass, and copper within aluminum. Good bonding is achieved at the interface. The outside diameter of parts must be circular, but not necessarily cylindrical. For example, there are strong indications that tapered gun barrels, complete with rifling, can be successfully produced.

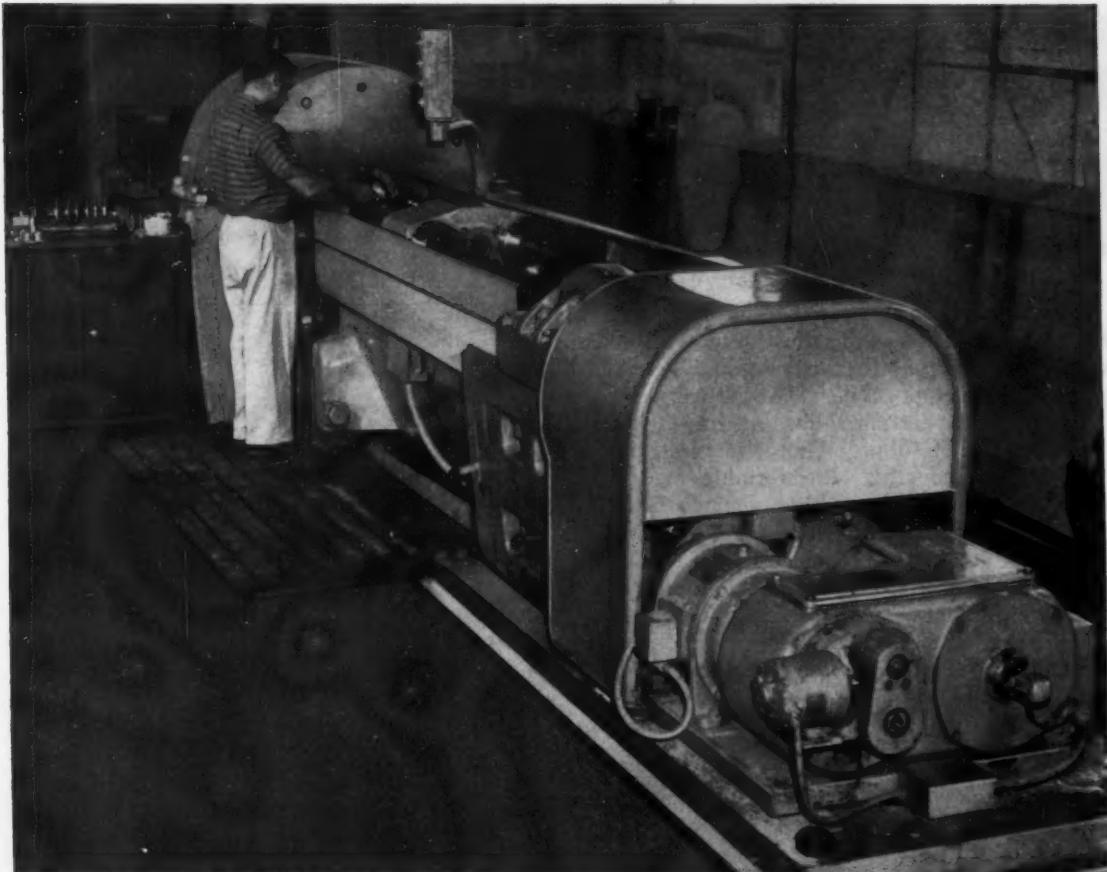


Fig. 1. Massive 200-ton Intraform machine moves mandrel slide by means of heavy lead-screws toward the headstock in the circular housing.



Fig. 2. Annealed M2 tool-steel blank is placed on the Intraform mandrel. Mandrel head will carry the work into the dies behind the operator's hand.

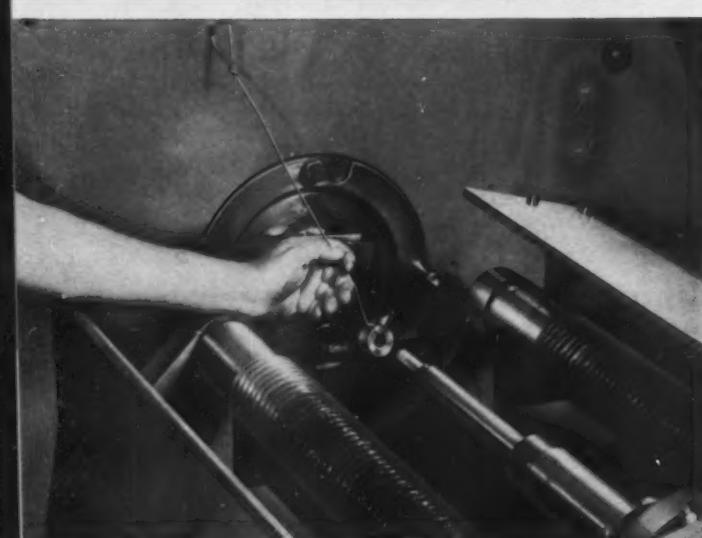


Fig. 3. Too hot to handle after forming, the tool-steel work-piece is taken from the mandrel on a wire hook.

The internal form need not be symmetrical, Fig. 5. In the center of this illustration is a splined sleeve coupling for a farm tractor which contains three different tool profiles. This sleeve was formerly made by cutting splines in three separate short lengths of tubing. Then the three pieces were welded together. Intraforming made the sleeve from one piece in thirty seconds. The necessity of stripping these sleeves from a mandrel slows production to somewhat below the usual rate of about 150 pieces per hour attained with many of the short-length pieces in the illustration. These, having straight walls, can be pushed through the headstock when unloading the machine automatically.

Howell Gear Co. has gained much valuable experience in designing and making mandrels and dies. Forming causes considerable lengthening of the work-piece because the displaced stock has to "go somewhere." The initial hole size of the blank and the total weight are governing factors at the start. When parts are long and the reduction in section area is severe in hard-to-work materials,

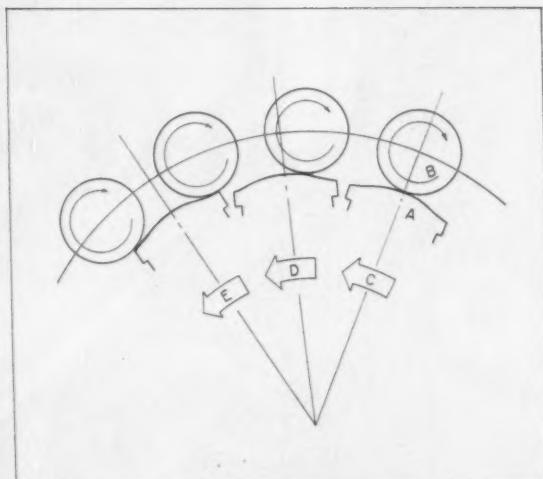


Fig. 4. Sine-curve form of Intraform cam (A) in continuous contact with roller (B) results in smooth, vibrationless squeezing action as the cam head rotates counterclockwise, moving the die radially.

such as the tool-steel punching pin (Fig. 6), the forming is done in two passes. They are interspersed by an annealing step lest work-hardening of the part cause spoilage of the work-piece and the dies.

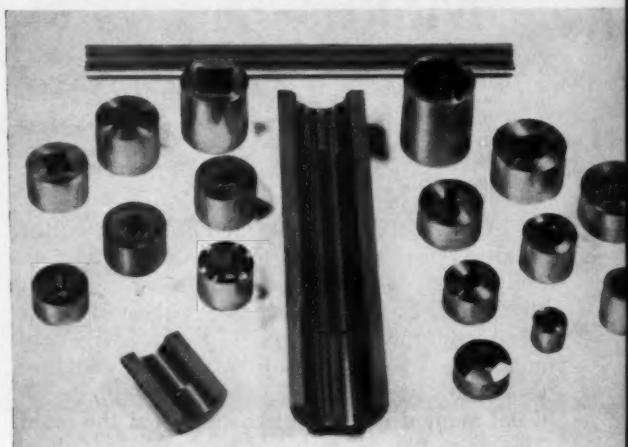
The machine and its operation are both new to Howell Gear. However, working data are gradually being accumulated. Each job is separately engineered from start to finish. The most critical decisions are those regarding production blank weight and dimensions. In time, out of Howell Gear's experience will come an optimum work-blank size and weight that gives the required finish dimensions and the proper degree of cold working to most greatly benefit the grain structure of the work metal, Fig. 7. Fatigue life of tool steel is noticeably improved; hardness and tensile strength are both increased. With Intraformed parts, distortion of the work is less likely to result from subsequent working, stock removal, and heat-treating operations.

Howell Gear Co. often achieves a surface finish in the neighborhood of 2 micro-inches on the bolt trim-die inserts. The inserts must be heat-treated, raising a scale which roughens the surface a little.



Fig. 6. Not all Intraformed work is internal profiling. Punching pin (top) was cold-drawn from the high-speed blank (below) in two operations.

Fig. 5. Wide variety in size and profile is shown by this group of parts produced at Howell Gear Co. Not all profiles are symmetrical. In the center is the tractor shaft coupling with three different profiles.



The dies are face-ground on the bottom and outside diameter. The top is sharpened to the cutting edge (heading illustration), by grinding.

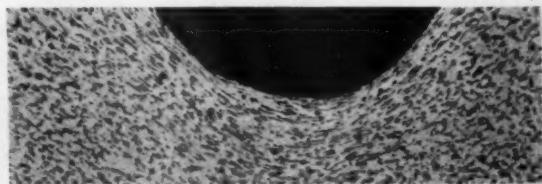


Fig. 7. The excellent grain flow and structure refinement are evident in this photomicrograph of the root of a steel ratchet tooth made by Intraforming.

## INCREASE PREDICTED IN MACHINE TOOL SALES

The recent Machine Tool Exposition sparked unprecedented interest in the technological progress made by the machine tool builders since the previous national showing of their wares in 1955, according to The Value Line Investment Survey. The tempo of machine tool ordering, partly as a result of the exposition, will average about 40 per cent higher in the next nine months than in the January-September 1960 period.

Demand for machine tools, The Value Line Survey publication predicts, will originate in three principal areas:

1. Small job shops. This was their only opportunity in five years to size up competitive machines. They are likely to use accumulated funds to purchase now.

2. Foreign manufacturers. The rapid industrial growth abroad has booked foreign tool producers to capacity, and their overflow of orders is being diverted to U. S. tool plants.

3. U. S. automobile industry. These companies have spent less than two-thirds of their depreciation on new plant and equipment in the past two years. Indications are that these outlays will be stepped up to at least the level of depreciation during the next year or two.

Thus, advances by the machine tool industry are expected in 1961 against a possible declining general business trend. There appears to be some promise of a major cyclical recovery in sales and earnings for the machine tool industry between now and the mid-sixties.

# Mechanized Work-Unloading Device Makes Die Casting Fully Automatic

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Rochester Products Division,  
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A LONG-CHERISHED HOPE of die-casting producers has been that somehow, sometime unloading of the work could be mechanized. At Rochester Products Division, General Motors Corporation, Rochester, N. Y., this goal has been achieved. Several Reed-Prentice machines and their tools are being modified to eliminate the usual manual removal of casting from the mold. The zinc-alloy parts being made are details of automotive carburetors.

The most advanced of the mechanized units is a Model 1 1/2 Reed-Prentice machine, Fig. 1,

which is tooled for making venturi clusters. With each shot, the molds produce two parts which are connected by runners to a hub. However, in addition to the usual molding, the machine unloads the shot automatically, cuts the venturis from the gate, and then transfers the unused sprue and runner portion of the casting back to the machine's holding pot for remelting.

No substantial changes are required in the dies themselves to adapt them to the new mechanized setup. They are of the unit or insert type and are made, as Figs. 2 and 3 show, to fit mating recesses

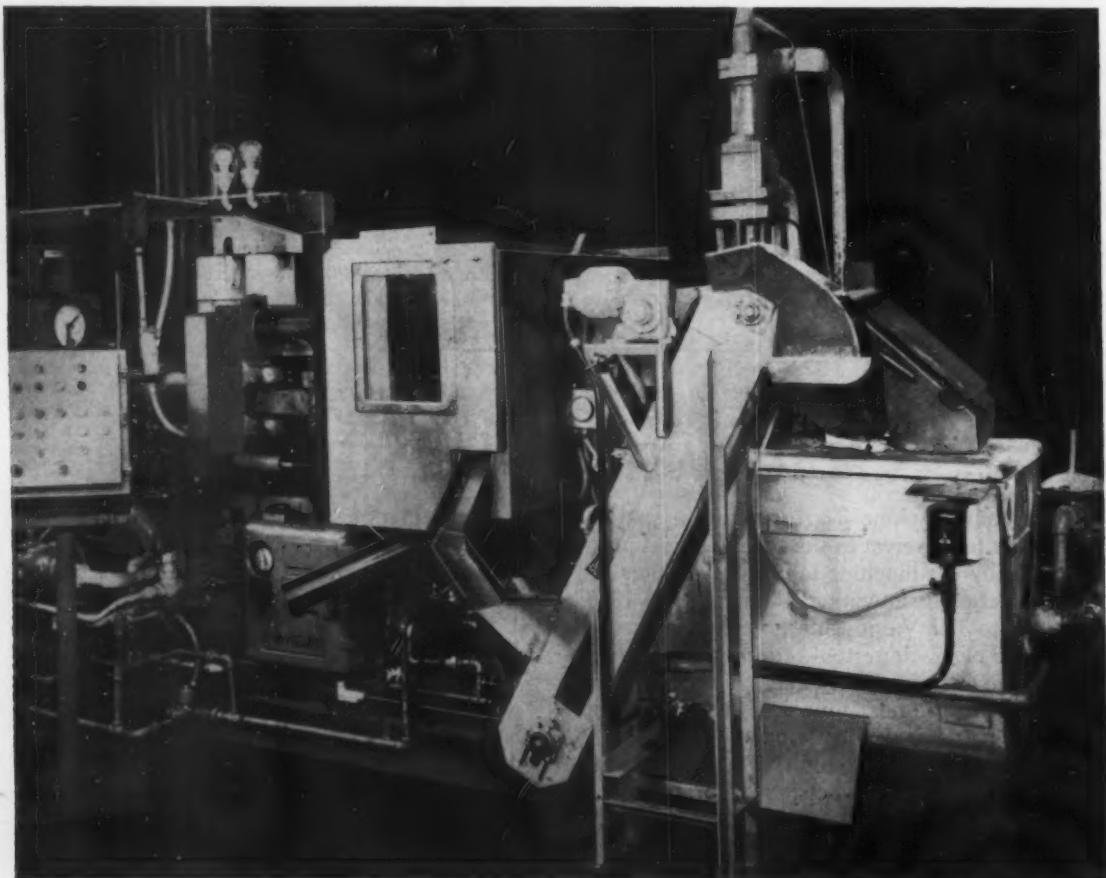


Fig. 1. Fully mechanized Reed-Prentice die-casting machine. Castings slide down chutes through the guard. The gate is returned to the melting pot via the elevator conveyor on the right.

**Hot, tedious manual take-out of die castings is replaced by a novel unloader built into the tools. Used as parts of an ingenious handling device are the integral runners which support the ejected castings during the transfer to the automatic degating station. The operation cycle is now much shorter and efficiency improved**

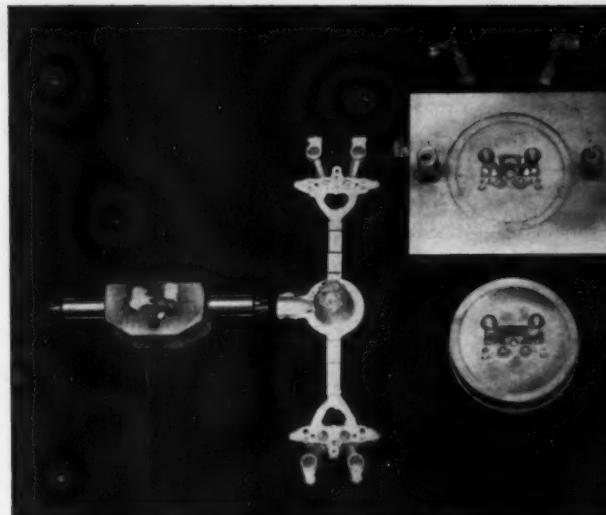
in the chase, or holder, that positions the unit dies. Each die unit has a conventional cavity sunk to produce a casting of desired shape and size. Two dies are accommodated in the mechanized setup now used, one being above and one below the sprue hole at the center of the holder. From the sprue hole, there is one runner passage leading out to each die.

In conventional unit die-holder setups, there are, at the center, recesses only for the sprue and runners. But in the automatic setup, there is an added side recess, as Figs. 2 and 3 indicate, which forms a zinc hub socket around the shank of the unload arm. This arm is pivoted at its center on a supporting shaft, resembling the vertical of the letter T. The end of each arm has deep slots milled on two diameters, forming a mating key with the hub socket when the shot freezes.

When the molten zinc alloy is forced into the die, the zinc fills the sprue hole, runners, and die cavities in the usual way, as well as the hub-socket recess. Metal forming the hub shrinks around the arm end that protrudes into this recess. After a dwell to allow the zinc to solidify, the die is opened as in conventional practice, breaking off the sprue at its small end. Ejector pins in the dies then eject the whole gate (castings included) out of the rear die. At the same time, the unloading arms and their shaft also move forward relative to the movable half of the mold. The inner end of the arm is frozen in the hub socket, Fig. 4.

When ejection is complete, the whole gate is free of the die, supported by the end of the unloading arm on its central shaft. Thereupon, the shaft-powered by a small air motor in the platen-indexes 180 degrees, swinging the arm and the gate out of the dies to the cutoff area. At the same time, the free end of the T-arm is now between the dies. The shaft retracts as the die closes, this new arm end assuming the same position in the die as the first end assumed in the prior cycle. Fig. 5 shows the open die with the gate of castings supported on the arm near cutoff position after being indexed 180 degrees.

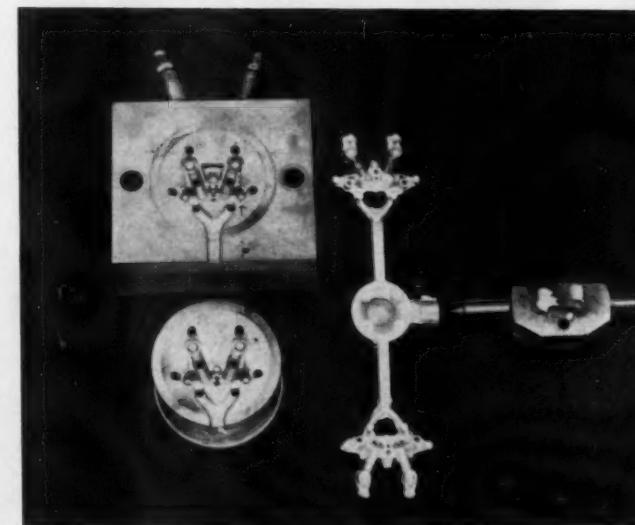
As the die closes, the gate (still attached to the arm shank on which it was cast) comes between shearing knife edges on the side of the die-holder.



**Fig. 2. Rear halves of a pair of unit dies (right). In the center is a gate of venturi castings, top and bottom, and (left) the unload arm around whose tapered end is cast a hub integral with the central sprue.**

They crop the two castings from the runners while the gate is pressed against a pair of cutoff blocks. The lower casting drops into a chute. An air jet blows the upper casting into a separate chute. This leaves the scrap center portion of the gate (sprue, runners, and hub) still on the end of the arm, but this portion is immediately stripped from the arm end by an air-operated plunger within the arm. The gate falls into a separate chute provided for it.

**Fig. 3. Front halves of the dies in Fig. 2 showing the front of the gate. The dies fit a die-holder which has cavities for the sprue, hub, and runners. Thus, changeovers are fast and comparatively cheaper.**



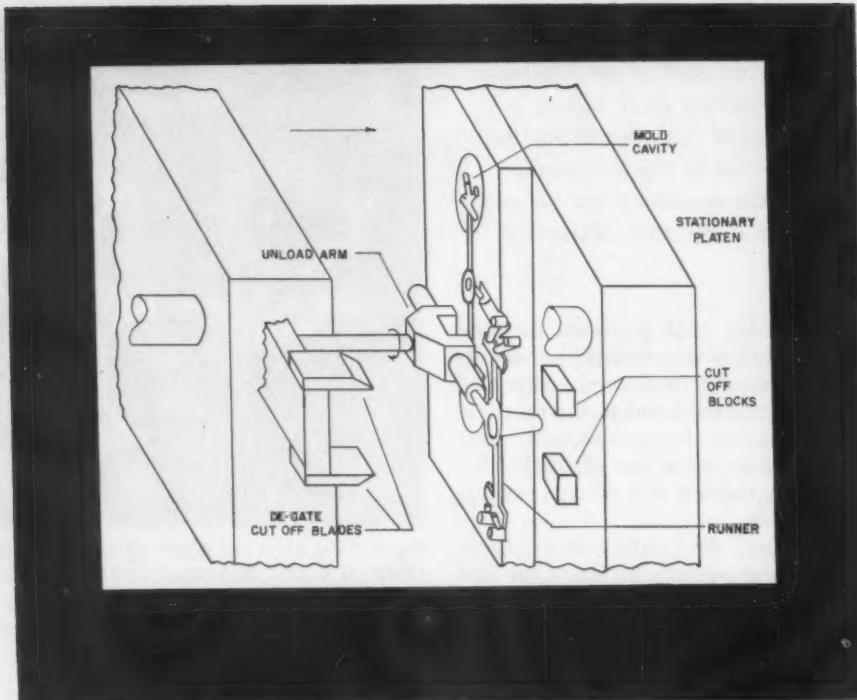


Fig. 4. Schematic sketch shows die open with casting supported on the unload arm. As the movable die (left) advances, it will close on the top end of the T-arm, and will support the next gate.

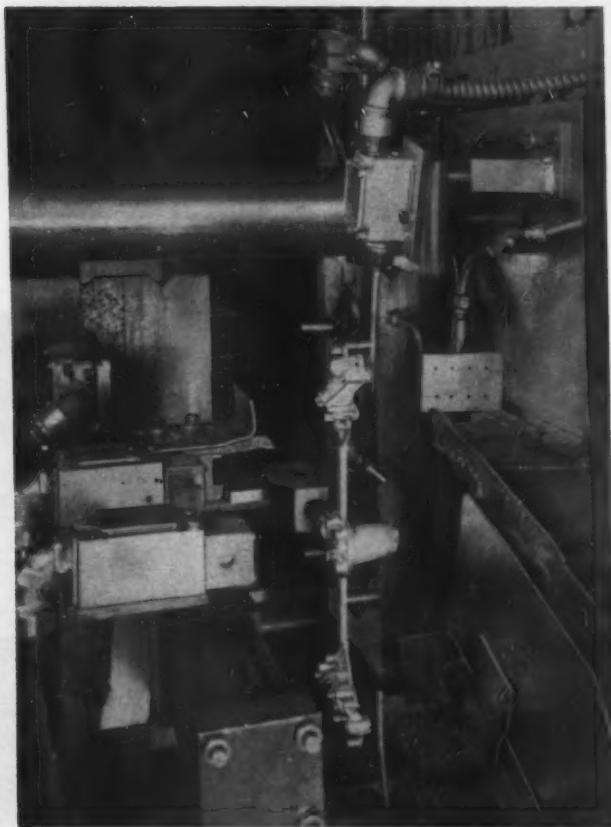


Fig. 5. Dies open with gate of castings in position for degating as the dies close. Work cropped from the top runner will be blasted by air into the chute on the right.

At the end of the cycle, the arm end thus freed is indexed 180 degrees again and enters the hub recess in the die, ready to repeat its function. Thus the arm ends of the T are used alternately to transfer the gates out of the dies and into position where cutoff occurs.

The gate scrap slides off its chute onto a short belt type elevator that runs continuously. It discharges into a chute leading into the molten-metal pot. This metal, of course, is kept at proper casting temperature by the gas-fired furnace which is a part of the machine. More heat is supplied than is usually required for holding purposes because the scrap gates must be melted. Castings from the machine are to be taled to a trim press for flash removal.

Although the machine setup that has been described is truly automatic, it is not expected to operate indefinitely without attention. It is contemplated that a single operator will be able to tend a group of machines. Included in the new machine is a spray type automatic die oiler and electrical interlock circuits for automatic cycling, prevention of damage to the machine, and elimination of hazards to the operator through malfunction. Thus, if a casting or a part of the gate sticks in the die, or if complete die closing does not occur, the machine stops and an indicator light goes on. Then the machine will not cycle until the cause of the stoppage has been remedied.

Extending back from the movable platen is a plunger rod connected by a rack and pinion to a converted cam timer. The timer operates a series of limit switches that control programming of the cycle. If any of the interlocking switches fails to function, the machine stops until the fault is corrected. This lockout applies especially to newly added automatic features. Original interlocks for functioning of the machine cycle itself are unchanged, except that the manual start button is used only for setup and starting after a shutdown.

To avoid possible accident hazards that might arise if a bit of flash, failure to eject, or other obstruction should prevent the dies from closing completely, various special controls supplement those commonly used on die-casting machines. One safety device is an unusual application of two Moore air gage indicators. These are air-operated at low pressure and connected by small tubes leading to passages opening at several points on the parting faces of the dies. When the dies are fully closed, the openings are shut off and thus back pressure builds up in the system as indicated by the gages. The back pressure is interlocked by valves with the machine's electrical controls that permit the shot (die filling) to be made. If an obstruction prevents full closing, the sequence controls do not function and the

cycle stops. This, in addition to the standard built-in controls, provides extra safety.

There is also a safety control that detects unloading of the die. This automatic check is accomplished by two spring-actuated limit switches which are closed by contact with the two castings after the unload arm indexes and just as the die starts to close. If the switches do not make by the time the die has closed a set distance, the normal sequence is interrupted, the mold opens, and the automatic cycle stops. Thereupon, a flashing red light indicates that a casting is stuck in the die.

Any two unit die pairs that will fit the holder can be used. Each cavity may be the same, or pairs may be different. The setup is designed primarily, however, to make venturi clusters in several different patterns. Each cluster has several cored holes, but all core pins in these venturi castings are at right angles to the die parting. Side or angle cores can be used if needed unless they interfere with the unloader-arm mechanism.

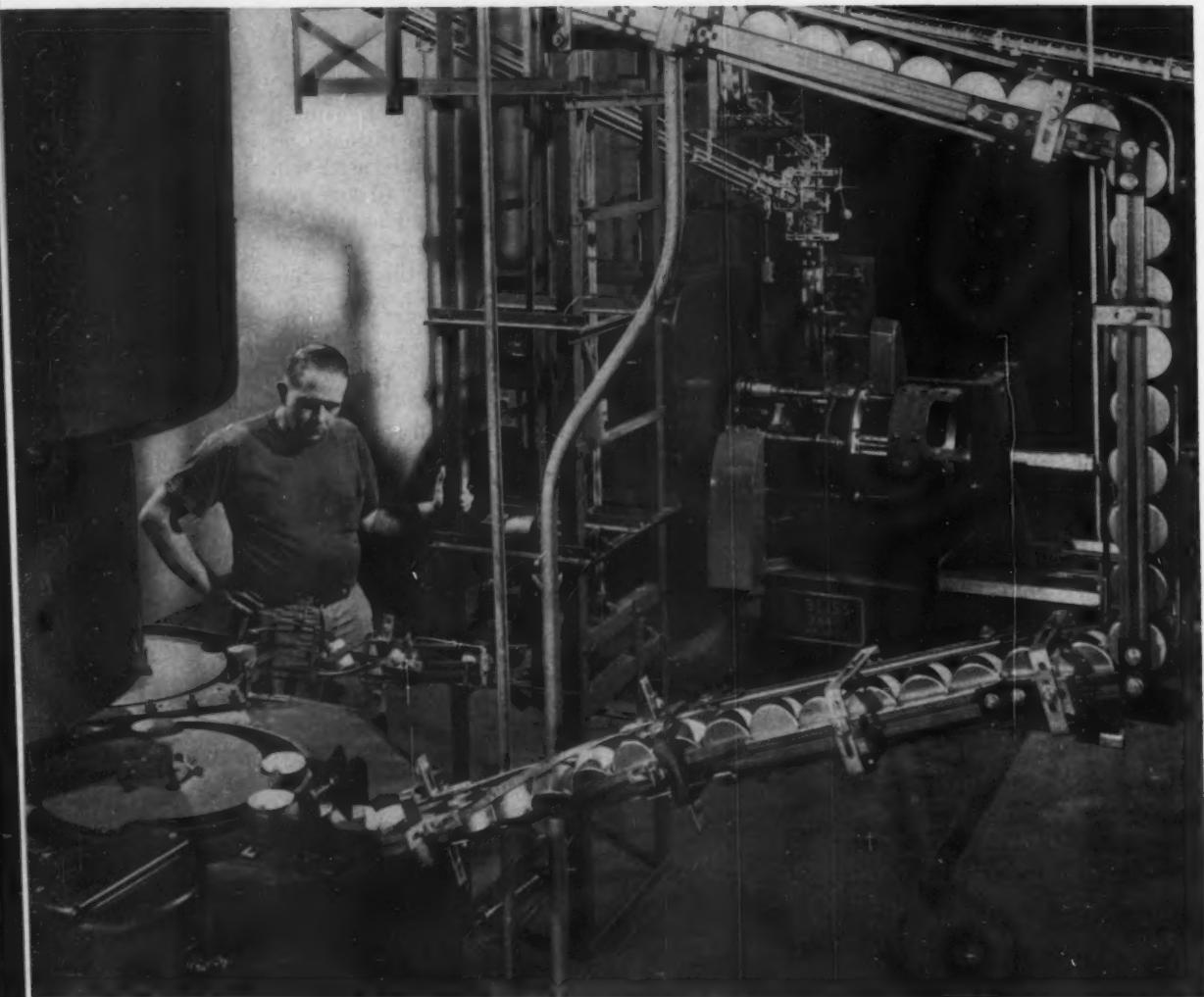
## Temperature-Hardness Characteristics Of Tools

In any cutting operation most of the power applied to the tool is converted into heat in the cutting zone at the tool cutting edge. A large percentage of this heat is carried off in the chip, but there is a significant rise in the temperature of the tool near the cutting edge. It is known that both high-speed steel and carbide tool materials lose hardness and cutting efficiency as their temperature is raised. Thus, if the cutting tool temperature becomes high enough, its hardness drops to a point where wear becomes very rapid. In the case of high-speed steel, a cutting zone temperature in excess of the tempering temperature can cause a permanent loss of tool hardness.

The critical cutting temperature for any cutting tool depends upon the work material, the tool material, the cutting speed and feed, and the cutting environment (cutting fluid, etc.). The temperature developed also increases with tool dulling and nearly always exceeds the critical cutting temperature at failure.

The addition of alloying elements such as cobalt to high-speed steels will increase their hardness at elevated temperatures. Such tools are useful where high tool temperatures are developed. The cobalt high-speed steels tend to be somewhat harder and more brittle than regular high-speed steels, so it is important that rigid tools and high-strength cutting edge designs be used to realize the benefits from their increased temperature resistance.—From "Metal Cuttings," published by National Twist Drill and Tool Co., and Winter Brothers Company.

## In Shops Around the Country

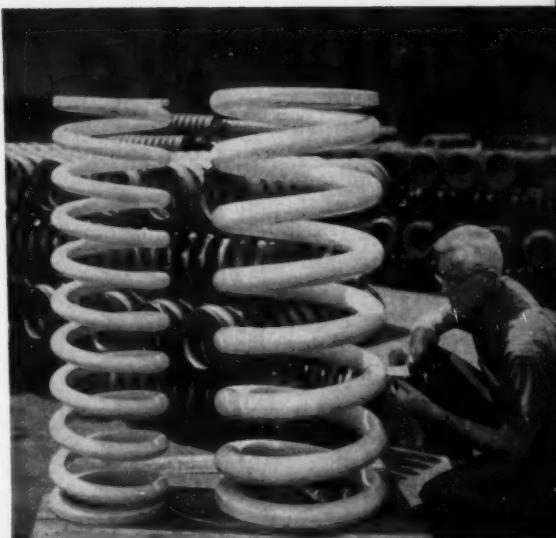


**CUP LINE**—Aluminum cups enter a Bliss rotary redraw press during second phase of fully mechanized manufacture, at Central States Can Corporation, Massillon, Ohio. Cups roll down chute into an upright position, then are fed by a star wheel into the four stations of a cam-like fixture. Later, cups enter the trimmer and flanger seen in the background. Material is precoated coil stock and is blanked and drawn in initial processing.



**SHRINK FIT**—Motor rotors for compressors are shrink-fitted to their shafts, at Carrier Corporation, Syracuse, N. Y. Positioned on a turntable, the rotors are indexed automatically through a three-stage Ther-Monic induction heater. The hot, expanded rotors are then picked up by an electromagnet on a transfer carriage and moved laterally to the compressor housing line seen on the left.

**MISSILE MOUNT**—These two hot-coiled springs, plus a third smaller spring, are nested concentrically to stabilize ICBM missiles on their launching pads. Designed and manufactured by the Union Spring Co., New Kensington, Pa., they are claimed to be largest springs ever made on a production basis. Each coil is wound in an opposite direction to the one it is set inside of, to avoid interference.



**BELL GRINDING**—After hard-surfacing, this steel bell for a blast furnace is ground on its seating area on a boring mill rigged with an angular tool-slide, at R. C. Mahon's Steel-weld Division, Detroit. The tool-head, carrying a 14-inch grinding wheel, moves toward the apex of the bell as it rotates. An 8-micro-inch finish is obtained.

# MATERIALS

The properties and new applications of materials used in the mechanical industries

## Low-Temperature Air-Hardening Die Steel Announced

The availability of a low-temperature air-hardening die steel, which will be marketed under the trade name Orbit, has been announced by the Crucible Steel Company of America, 4 Gateway Center, Pittsburgh 22, Pa. In addition to its free-machining qualities, this all-around tool steel (AISI Grade A-6) combines many of the advantages of air-hardening grades with the low hardening temperature of oil-hardening grades. Its hardening temperature is low enough so that it may be heat-treated without the use of expensive furnaces. It exhibits good machinability properties, is tough, and is dimensionally stable in the as-quenched condition.

## Honing Oil with Flash Point of 275 Degrees F.

A honing oil which meets the safety requirements of major American production plants because it has a flash point of 275 degrees F. has

been developed by Shear-Speed Chemical Products, division of Michigan Tool Co., 7125 E. McNichols Road, Detroit 12, Mich. Shear-Speed Formula 50, as it is called, has a combination of ingredients which permits stock-removal rates as high as those with straight kerosene. It can be used with all types of honing and Superfinishing machines and, because it is nonsulphurized, it can be used when finishing most metals. This fluid has good solvency, will keep the honing stone clean and free-cutting, has a low odor level, and minimizes drying of the skin. It is also particularly suitable for hard-gear honing.

## Screw-Machine Stock that Gives Consistency and Ease in Machining

An aluminum screw-machine stock which affords consistent and easy machining has been introduced by Kaiser Aluminum & Chemical Corporation, Kaiser Center, 300 Lakeside Drive, Oakland 12, Calif. A 2011-T3 alloy, called Micro-Chip, it offers fabricators good machining qual-



Heavy-duty protection from damage in assembly and shipping is provided by these lightweight but tough and resilient industrial caps and plugs, finishing flanges, and conduit-thread protectors. They are molded of Monsanto polyethylene by Niagara Plastics, Erie, Pa.

ties, plus a bright and clean surface which is important in operations where no stock is removed. The screw stock is color-coded and chamfered at both ends.

### Antivibrational Material Prevents Creeping on Slippery Surfaces

An antivibrational material, called Vibra-Check, that does not creep on slippery floors such as vinyl and asbestos tile has been made available by Lowell Industries, Inc., Allston Station, Boston 34, Mass. This synthetic material is composed of two layers of vinyl-chloride elastomeric resin bonded to both sides of a strong reinforcing core of monofilament fiber glass. It is resistant to moisture, oils, greases, detergents, brine, solvents, and many other chemicals. Vibra-Check has a breaking point of 7500 psi; is dimensionally stable; and, under high shock loads, shows no deformation or permanent set.

### Wide-Range Temperature-Indicating Crayons and Paints

Easy-to-use devices that accurately indicate the temperature of any hot surface by distinct changes in color are now being marketed by Air Reduction Sales Co., a division of Air Reduction Co., Inc., 150 E. 42 St., New York 17, N. Y. The changes are not slight alterations in the shade of the original color, but an easily discernible change to a different color.

Called Thermocron crayons and DetectoTemp paints, the materials provide a means of measuring temperatures in a 104- to 2462-degree range; the crayons provide a range of 150 to 1240 degrees F. and the paints, the entire aforementioned range. Eighteen crayons and thirty-six paints are available.

These materials can be used on all hot surfaces, including those exposed to a reducing atmosphere, atmospheric moisture, traces of hydrogen sulphide, and carbon-dioxide concentrations of up to 50 per cent. Sulphur dioxide and ammonia affect only a few of the paints and have no effect on the crayons. The presence of high voltages, magnetic fields, ionized gases, and static electricity have no effect on the accuracy of the crayons or paints.

The Thermocron crayons are useful when rapid measurement of heated surfaces are required, such as leaky steam traps and welding, die, and bearing temperatures. They can be used during welding or extruding operations, heat-treating and annealing, and glass production. The DetectoTemp paints are most useful when large areas are to be monitored, when the temperature indicator must be applied before heating, and

when the temperature range exceeds that of the crayons. They can be used for furnace walls, aircraft skins, jet engines, gas-turbine blades, air ducts, and exhaust lines. The paints can also be employed in unobservable areas such as power tubes in coaxial cables, brake drums, pistons, and other engine parts.

### Stainless Steel that Exhibits Good "Hot Hardness"

A grade of stainless steel, developed by Latrobe Steel Co., 2626 Ligonier St., Latrobe, Pa., that has good "hot hardness" is now being successfully subjected in use to maximum compressive stresses of more than 600,000 psi at temperatures in excess of 800 degrees F.

Designated Lesco BG 41 Vac Arc, this steel is being used for bearing assemblies in a pneumatically controlled mechanism which reverses the forward thrust of aircraft engines. It has a percentage composition of 1.10 carbon, 0.30 manganese, 0.30 silicon, 14.50 chromium, and 4.00 molybdenum; the balance being iron. In other words it is a modified form of AISI Type 440-C stainless steel with a molybdenum content that has been increased from 0.005 to 4.00.

Elevated-temperature tests indicate that the steel retains a hardness of 3 to 5 points Rockwell C above that for 440-C stainless. When exposed for 400 hours to a heat of 900 degrees F., the steel shows a drop of only 8 per cent in hardness, compared to an 18-per-cent drop-off with 440-C.

### Gear Compounds Applicable by Hand or Spray Application

Three gear compounds, available in two types each—for hand or spray application—have been announced by Bel-Ray Co., Inc., Farmingdale, N. J. One, "Molylube Open Gear Compound," is for heavily loaded open and semiopen gears. Another, "Molylube Gear-Kote Compound," is for heavily loaded open type gears. The third, "B-R Geartex Compound," is for protecting gears from "feathering" in abnormal shock loads.

The first, Molylube Open Gear, contains a large percentage of metallic lubricants (Molybdenum disulfide) and other extreme-pressure additives. The metallic film withstands heat at temperatures up to 750 degrees F. and high pressures. This compound never requires heating before being applied, yet is as tenacious as a much heavier material.

The second, Molylube Gear-Kote Compound, contains high-molecular-weight polymers which give good film adhesion and prevent scoring, galling, and pitting of gear teeth. It can be used in the same temperature range as the first com-

pound and at higher gear contact pressures.

The B-R Geartex compound is waterproof and easy to apply, will withstand abnormal shock loads, and has a high cohesive rating.

#### **Durethene Polyethylene Film Protects Machine Tools in Shipment**

A convenient and economical method for protecting machine tools in shipment is being used by Ingersoll Milling Machine Co., Rockford, Ill., through the use of Durethene polyethylene film, a product of the Plastics Division, Koppers Co., Inc., Koppers Bldg., Pittsburgh 19, Pa. The machine tools which have previously been loaded on flat cars are first covered with reinforced papers so that sharp projections will not tear the Durethene film. For this particular application the film is used in widths ranging from 16 to 28 feet, but may be obtained in unseamed widths up to 40 feet. Straps of black cotton webbing are used to hold the film in place during shipment. The film material is cheaper than the canvas previously used and may be put in place more easily.

#### **Flux for Brazing and Welding Cast Iron**

A product which facilitates continuous brazing operations without the necessity of painting the metal with powdered flux and without dipping the welding rod into powdered flux has been announced by Rexarc, Inc., West Alexandria, Ohio. Called Rexarc Cast Iron Liquiflux, it enters the flame automatically in a vaporized state with the

gas stream and passes through the welding torch into the flame. No special torch is needed.

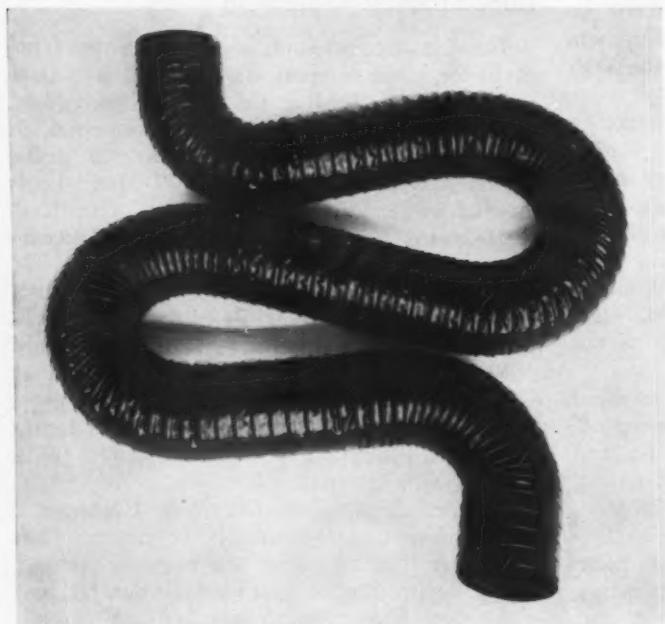
The flux, in the form of a liquid, is placed into a piece of equipment known as a Liquifluxer, which in turn is hooked up to the tanks of gas. Gases used with this flux must be dry. The brazing operations which may be performed are: steel to cast iron, and brass to cast iron. Welding operations include cast iron to cast iron and hard facing with chromium cobalt tungsten.

#### **Cobalt-Tungsten Superalloy with High-Temperature Strength and Ductility**

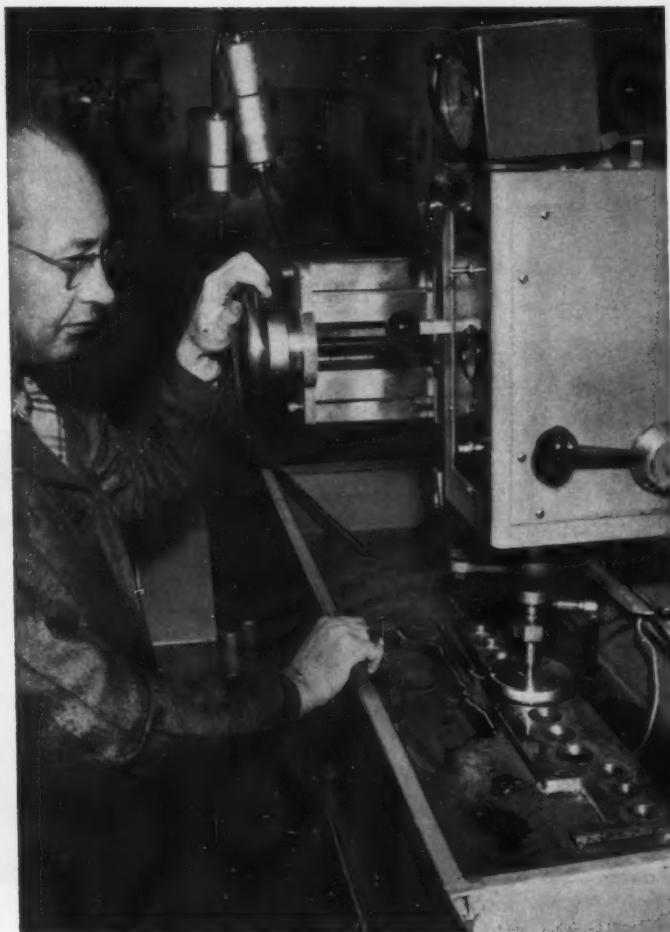
A cobalt-base high-tungsten superalloy that possesses high-temperature strength in the 1850-degree F. range, with good ductility and corrosion resistance, is now commercially available in both shot and ingot form from WaiMet Alloys Co., 5320 Oakman Blvd., Dearborn 2, Mich.

WaiMet improved WI-52 superalloy, as it is called, has a percentage composition of: tungsten, 10.0 to 12.0; chromium, 20.0 to 22.0; carbon, 0.40 to 0.50; nickel, 1.0 max.; iron, 1.00 to 2.50; columbium and tantalum, 1.50 to 2.50; phosphorus, 0.040 max.; sulphur, 0.040 max.; manganese, 0.50 max.; silicon, 0.50 max.; and cobalt, the balance. Acceptance tests at 1800 degrees F. and 15,500 psi showed an average stress-rupture life of seventy-three hours, with an average stress-rupture elongation in 1 inch of 17 per cent.

This air-melted superalloy has good castability and foundry characteristics. Its primary use has been in investment-cast aircraft gas-turbine parts, such as vanes and blades.



This neoprene-coated fiber glass fabric which is spiral-wire-reinforced is lightweight, flexible, and has flame resistance and a high burst strength. Designated Flexaust GlasHose, it is available from the Flexaust Co., 100 Park Ave., New York 17, N. Y., in sizes from 1 1/2 to 24 inches inside diameter. The hose is designed for air-handling and fume-control applications in an operating temperature range of -40 to +300 degrees F.



"Electroless" nickel plating on . . .

## WOODEN ELECTRODES FOR EDM

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ADDED INTEREST in the mushrooming field of electrical-discharge machining (EDM) seems assured by an *electroless* nickel-plated wooden electrode. The new tool has been developed by Grumman Aircraft's Equipment and Process Engineering Department.

By the nature of the EDM process, the shape of the cavity produced is controlled by the cross section of the electrode. When a cavity design is intricate or nonsymmetrical, the machining of a metal electrode—even one made of brass—can be difficult and time-consuming.

An electrode fabricated of wood, on the other hand, can be rapidly constructed, electroless nickel-plated, then electroplated with copper or some other required metal. Such an electrode is ideal for experimental work or for short runs. Once a cavity design is approved, a more permanent all-metal electrode can be built.

Electroless nickel plating evolved from the research of Brenner and Riddell back in 1946. After the outbreak of the Korean War, several companies became interested in the process as a solution to problems encountered in manufacturing specialized ordnance items. Today, the elec-

troless deposition of nickel is a fully established industrial technique.

As the name of the process implies, the plating requires no electric current. After suitable preparation, the work is immersed in a solution containing nickel, hypophosphite ions, and other additives. The hypophosphite is catalytically dehydrogenated and then the nickel is reduced by the evolved hydrogen.

Nonmetallic materials can also be plated if brought into contact with a catalyzing substance or coated with a thin layer of palladium. There being no electric current, the bath has an almost infinite throwing power, and thus can plate uniformly in deep recesses and around sharp corners.

In addition to plating EDM wooden electrodes, electroless nickel is being used successfully in applications requiring electrically conductive, thermally resistant metallic films on nonmetallics; antigalling coatings on titanium dies; and adherent coatings on titanium, vanadium, beryllium, and molybdenum. Electroless nickel plating costs more than electroplating, so it is not directly competitive. Yet it does jobs its cheaper counterpart cannot do.



LAURENCE W. COLLINS, Jr.  
Associate Editor

## TURNING STATIONS

# INCORPORATED IN SECTIONED TRANSFER

**Unusual approach integrates new combination of different machining operations in a transfer line that processes raw castings into finished wheel hubs ready for assembly. Automatic chucking units are a transfer innovation**

BY COMBINING chucking lathe turning with operations normally done on a station type transfer machine, The Cross Company, Detroit, Mich., has simplified the complete, automatic finishing of turned precision parts. This sectionized chucking Transfer-matic, Fig. 1, includes all of the automatic-processing advantages of conventional transfer machines, and avoids many of the limitations of conventional turning machines.

With this new class of special-purpose machine tools, it is possible to start with a rough casting and completely rough- and finish-machine a part, including: turning, boring, facing, drilling, milling, broaching, and assembly operations. Parts requiring some, or all, of these operations can now be produced "straight-line" automatically with less handling, in greater quantity, with higher piece-to-piece uniformity, in less time, and

with greater accuracy. Typical parts, now processed in other ways, that could be processed on machines of this type are wheel hubs, flywheels, and differential cases.

The key member of the new class of machines is the new Cross chucking unit, a standardized "building block" that can be integrated with existing designs of building blocks for milling, drilling, and assembly. These units have the same flexibility as other building blocks. They are readily rearranged into new machines as production requirements change.

Transfer machines of this type are sectionized (Fig. 1) so that operations that are similar, or that can be performed in about the same cycle time, are grouped together. Any number of sections can be tandem-joined in one machine. Sections with different cycle times are usually balanced by

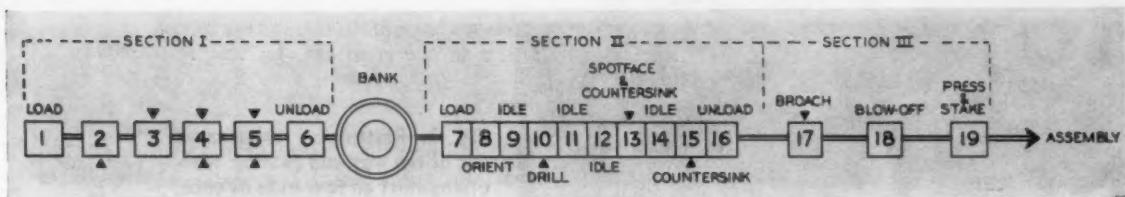


Fig. 1. The first two sections of the new Cross sectionized chucking Transfer-matic are connected by a rotating-drum storage bank. Work-pieces are processed four at a time in the first section (left) and one at a time in the second and third sections.

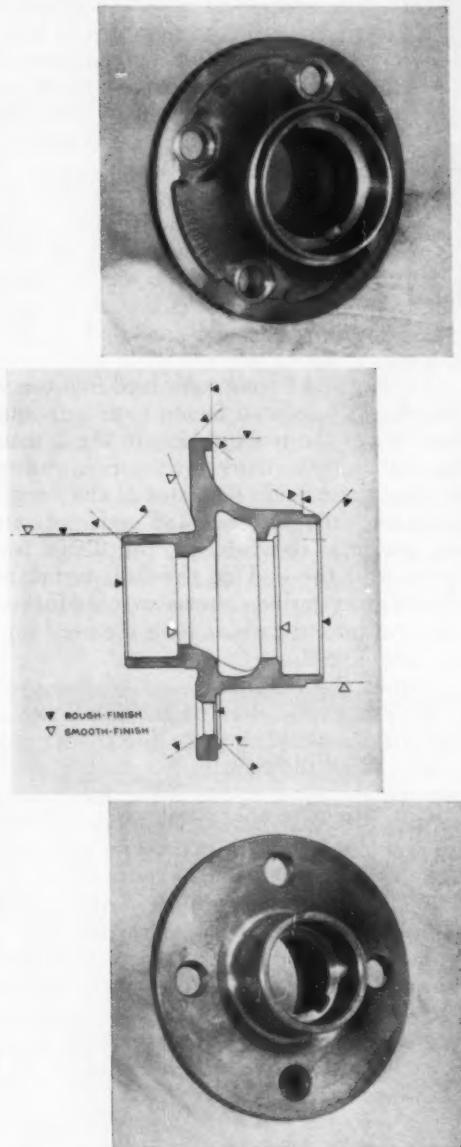


Fig. 2. Two sides of work-piece for new chucking transfer machine are shown. It is a malleable-iron wheel hub for a small European car. Roughing and finish cuts are made according to the legend in the center.

coupling them through an automatic work bank or parts-accumulator magazine. Long-cycle operations are usually performed on two or more parts at the same time, while faster machining operations are usually performed on one part at a time. Production capacity is keyed to the longest cycle time of any of the machine's sections, modified by tool maintenance schedules. Extra productive capacity is provided for those sections requiring more frequent tool changes.

Grouping of operations is, of course, predicated on the sequence in which operations must be performed to process the part. But all chucking operations, for example, are not necessarily grouped in just one section if both roughing and finishing cuts are required. One advantage of sectionized chucking Transfer-matics is that accuracy of the finished parts is unusually high. Frequently, all finishing operations for related dimensions can be done in a single station. Once the interrelationships between the individual cutting tools have been established, production parts are made uniformly, holding close limits. A second advantage is that the work-holding chucks best suited to the operation can be used at machine stations as required. For example, heavy-duty three-jaw chucks can be used for roughing, and diaphragm chucks for finishing. Thus, clamping distortion is not introduced to affect the accuracy of the finished work.

A good example of the new sectionized chucking Transfer-matic design has been built to manufacture wheel hubs for a small European car. The work-piece is delivered to the first section of the transfer line as a rough, malleable-iron casting, Fig. 2. When it leaves the machine, it is ready for assembly on the axle. Operations are divided selectively among the various machine sections, according to types and cycle times required. The comparatively slow turning, boring, and facing operations are performed on four work-pieces at a station in the first section of the Transfer-matic Fig. 1. Faster drilling, broaching, and assembly operations are performed on one piece per station in the second and third sections of the machine.

The nature of the machining operations, tool life, and the number of tools used permit the second and third sections to operate at about 80

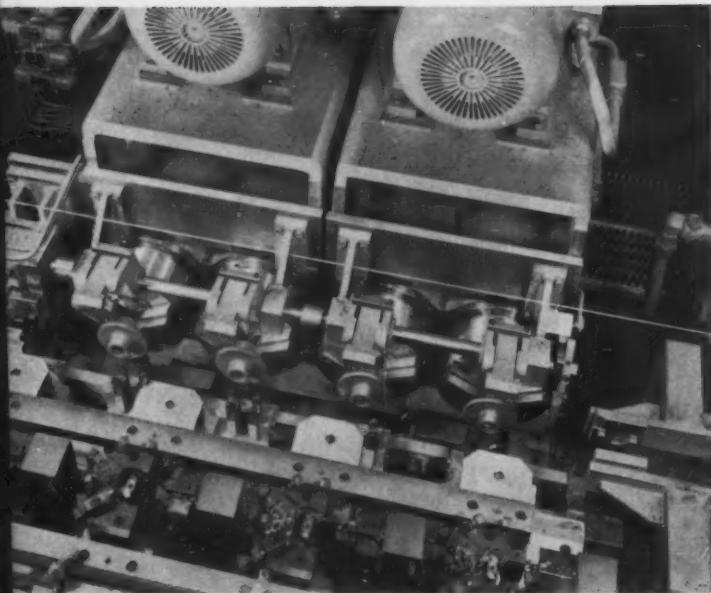


Fig. 3. Restraining arms move out of the way and turning operations start on four hubs at once.

per cent efficiency, while the first section operates at only 65 per cent. Extra capacity has been provided in the first section so that its production output balances with the second and third sections. Between the first two sections of this transfer machine, Fig. 1, is a cylindrical work bank with capacity to supply the second section of the machine for about one-half hour. The banking machine is a FIFO, the acronym for "first part in is the first part out." The rotating speed of the bank drum can be varied to balance the operations of Sections I and II. A hub, delivered to the bank when it is empty, will be available to the second section in about one minute at the fastest drum speed.

Operating at average efficiency, this line completes about 160 wheel hubs per hour. They have uniform quality and high accuracy. Work-pieces are manually loaded in nests at the load station, four at a time. Flanges are held vertical and the small end of the hub faces the operator. The transfer bar rises, lifts the work-pieces out of the load-station nests, and transfers the four pieces as a group to the first machining station in the first section of the machine. Four conventional three-jaw chucks move forward part way, with their open jaws surrounding the largest hub diameter. Mechanical arms then swing downward to hold the parts in the chuck jaws. The transfer bar lowers. With the arms lightly pressing the castings into the chucks, the chuck jaws close to center and clamp the parts. The restraining arms then swing upward out of the way, Fig. 3. The chucks next move forward to a positive stop and machining operations begin, Fig. 4.

Turning and boring tools feed into the work as the chucks turn, and facing tools simultaneously feed across the work-pieces. In the first machining station, two diameters are finish-turned (including the outside diameter of the flange), one diameter is rough-turned and undercut, one bearing pocket is rough-bored, the flange is rough-faced, and the end of the hub is finish-faced. Throw-away carbide inserts are used for roughing cuts and brazed-carbide tools are used for finishing cuts, Fig. 2.

During the cutting period of the cycle, the transfer bar returns to its starting point. At the end of the machining cycle, the chucks pull back part way and the transfer bar rises. The jaws are released and the four parts drop into nests on the transfer bar as the chucks withdraw to their starting position. (There is no need for the restraining arms during dechucking.) Parts are then automatically transferred into the next chucking station. Identical procedures are followed in the second machining station, except that the opposite ends of each hub, just machined, are chucked. One diameter is finish-turned, one bearing seat is rough-bored and chamfered, the back face of the flange is finished, and the large end of the hub is finish-faced and chamfered.

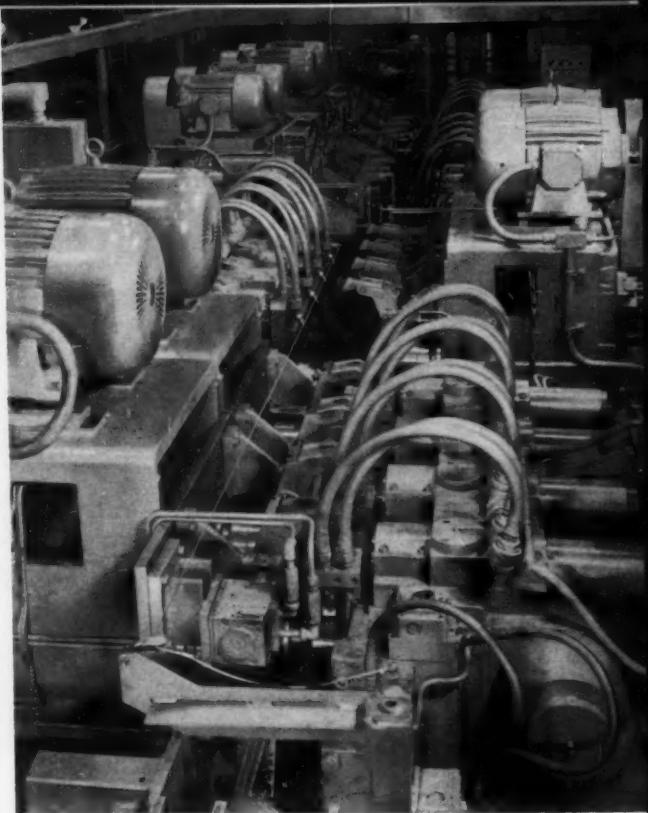
In the fourth and fifth stations, operations are performed simultaneously by tools advancing from both sides of the transfer line. The work-pieces are now held in diaphragm type chucks to increase accuracy. Operations include: semifinish and finish turning of the brake-drum diameter, semifinish and finish boring of the bearing pockets, and semifinish and finish facing of the flange,

Fig. 4. Chucks are brought all the way forward and cutting tools feed into the parts four at a time in each station.

Fig. 2. Bearing bores have a surface finish of 70 to 75 micro-inches, and dimensions interrelated by close tolerances are all achieved in a single station. Also, because parts are unclamped as they move between stations, internal stresses cannot build up to cause loss of accuracy as the parts age.

This transfer machine is designed so that Sections I and II can operate independent of each other. Depending on conditions of casting supply and tool maintenance, the work bank can be operated with either Section I or II. In normal operation, however, work-pieces are deposited on the inclined input rails of the bank by the transfer bar of Section I. A swinging arm on these rails prevents the hubs from jamming. They roll down to the bottom of the work-bank magazine and, leaning against the powered rotating drum and constrained by rails, they "walk" in a spiral up the drum, Fig. 5. The bank has a capacity of about 140 parts. If the bank fills completely, Section I shuts down automatically.

From the top of the drum, parts discharge via a "cushioned-drop" escapement to inclined rails leading to a stop in the load station of the second section of the Transfer-matic. The presence of a part in the load station closes an air jet to initiate the cycle. If the part is improperly placed in the station (parts may be loaded here manually) the machine will not operate. From here on the parts



are handled and processed one at a time, instead of in groups of four.

The transfer bar of the second section rises, lifts the wheel hub off the rails, and deposits it in an orienting station, Fig. 6. Here a plunger picks up two notches on the internal diameter and ro-

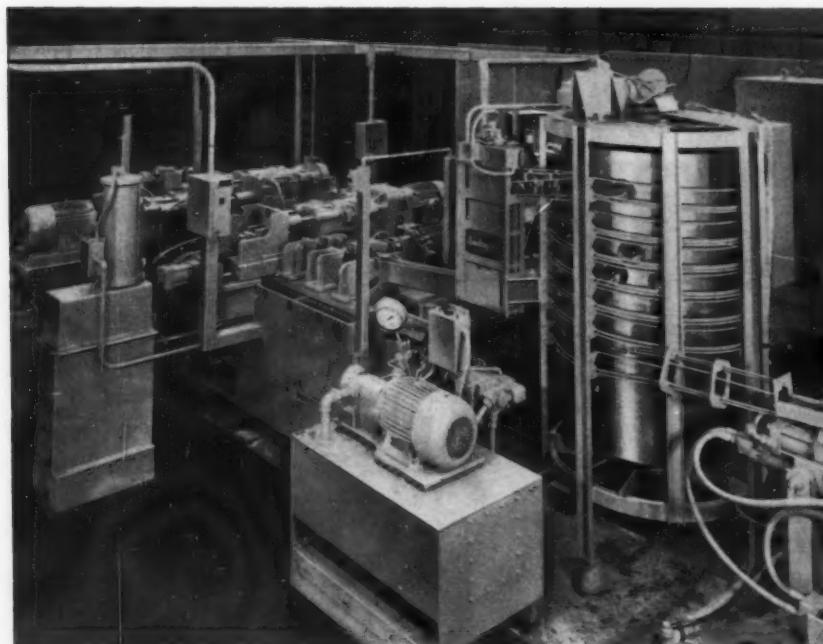


Fig. 5. The last transfer in the first section deposits four hubs on inclined rails so that they roll to the work bank from the right. They walk up the drum by friction and are cushion-dropped into the load station of Sect. II, left.

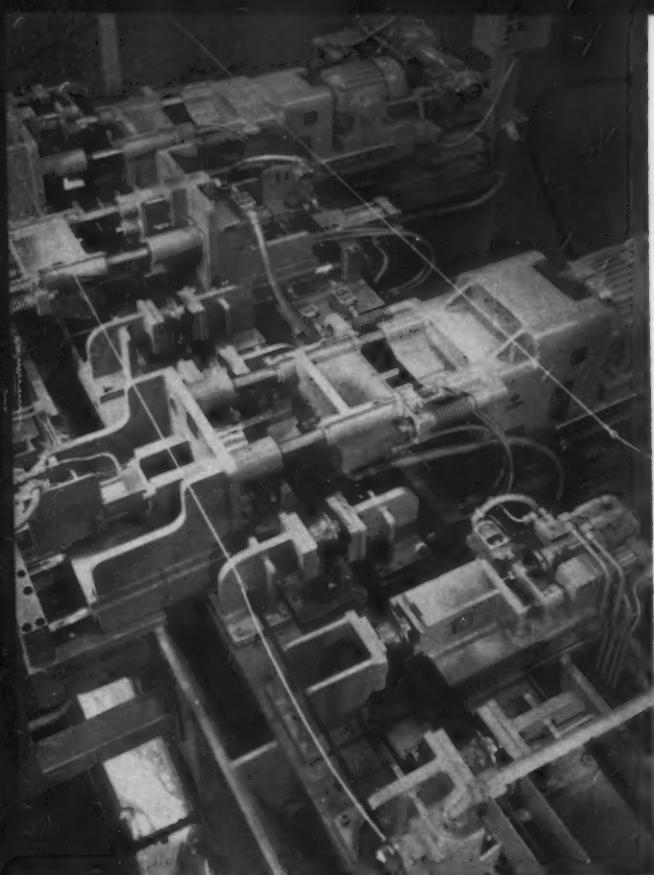


Fig. 6. Hubs are delivered from the bank to the load station, right foreground, where they are picked up and transferred to the orienting station.

After passing two idle stations the hubs are deposited in Station 13, where the four stud holes are spot-faced and countersunk. Another idle station is passed and then the four holes are reamed in Station 15.

The third section includes broaching, assembly, and staking stations, with hubs transferred on their sides. Spline broaches are pushed through the four stud holes simultaneously and are pulled back. Studs are automatically delivered to the assembly station from hoppers. Shapes of the splines on the stud shank automatically align in the hub holes.

Down time of this Transfer-matic is minimized because operations that will require more frequent tool changes are grouped together in one section. But gathering these operations together is only part of the machine's built-in answer to down-time problems. Each of the four chucking stations of Section I makes use of ganged tilting heads to facilitate tool changing. When the heads are tilted (heading illustration) all the tools face up. The operator can see, reach, and replace cutters easily because semipermanent platforms, Fig. 7, are supplied for the purpose. Accessibility has been provided at all areas by including at least one idle station between working stations.

Roughing cuts are taken with throw-away carbide inserts that can be indexed or replaced on the machine. Finishing cuts are taken with brazed-carbide tools that are preset in the grinding room. Because of the accessibility of tools on this machine, down time is minimized.

tates the part to the correct radial position. From this point on, the part is transferred by its stud-hole pockets. The hub then passes an idle station to Station 10. Here a plunger is again inserted in the internal notches to assure proper radial attitude of the work-piece before the four stud holes are drilled in the flange. (In succeeding stations, the part is oriented radially from one of the drilled holes.)

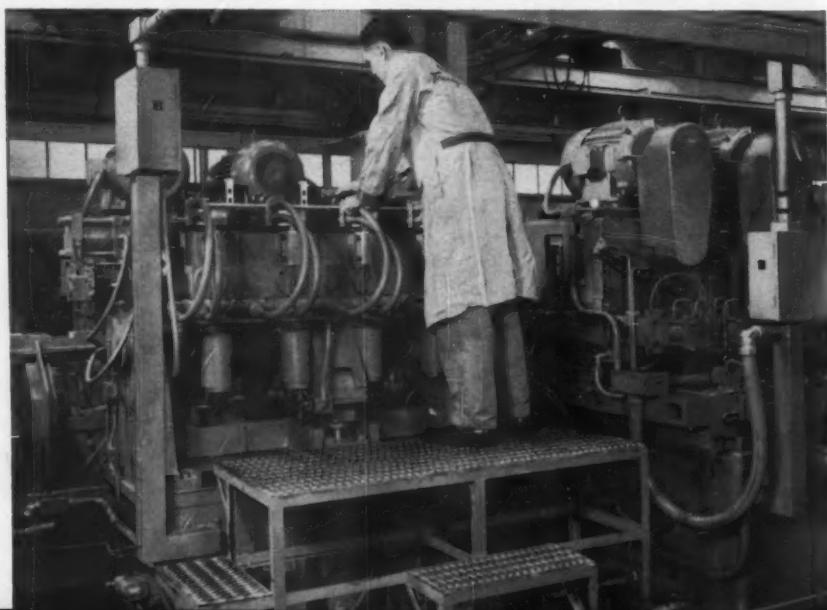
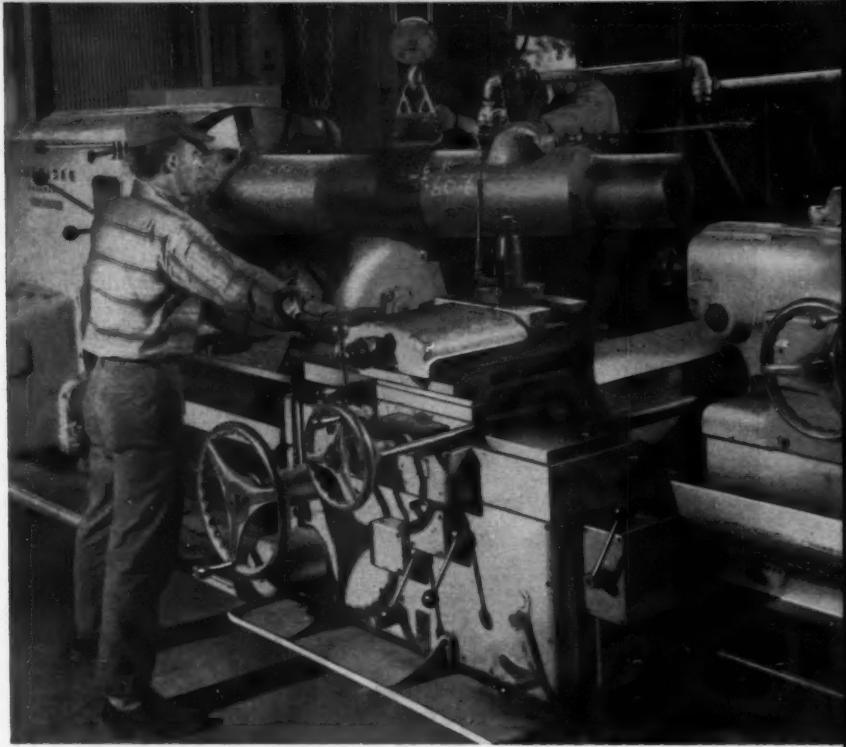


Fig. 7. To be at a convenient height for cutter maintenance, the operator stands on platforms next to the tool heads which swing upward.

# TITANIUM BILLETS TURNED WITH INCREASED KNOW-HOW



IN COMPRESSING into ten years the technological and production experience traditionally requiring twenty to thirty years, the titanium industry did not go unscathed in the market place. Its almost vertical ascent on the production curve was arrested in mid-1957, when construction of manned military aircraft gave way to requirements for unmanned vehicles. The reverse reaction was practically as sharp as the preceding upward climb.

Now it appears that titanium may once again be bidding for acceptance. The valuable properties of the metal that enabled launching of the titanium industry in the first place still remain: temperature resistance to 1000 degrees F., corrosion immunity to salt atmospheres and most oxidizing media, and the strength of steel at half the weight. Perhaps of greater importance in current technology are: new data indicating that titanium retains its properties at cryogenic temperatures; development of heat-treatable, high-strength alloys for missile applications; and declining prices which have actually made titanium one of the least expensive metals in jet-engine construction. An increasing awareness that titanium machines more freely than highly alloyed, corrosion-resistant metals may some day provide the impetus for nonaircraft applications such as chemical processing, nuclear power, and electronic equipment.

Titanium production is complex, demanding

the specific skills of chemistry for creation of the basic metal and maintenance of its desirable qualities; plus the knowledge of specialty-steel fabricating to turn out the finished product. In each case, selection of the right processing equipment and adherence to exacting quality-control procedures are highly important.

At the Toronto, Ohio, plant of Titanium Metals Corporation of America, forming operations start with hot forging. Ingots are initially press-forged, after which hammer forging and additional press forging can be used to produce the various sizes of billets and bars. The ingots are preheated to a range of 1200 to 1500 degrees F., then brought up to temperature immediately before pressing or blooming.

Temperature control plays such an important part in producing titanium of consistent quality that many of the furnaces are custom-instrumented. In some instances preheated dies are used when it is important to maintain heat as long as possible in the material being forged. The preferred forging practice is to work at steadily decreasing temperatures through light, fast reductions, with the in-process titanium reheated before each successive step.

Titanium has a low work-hardening rate and a low coefficient of friction. It requires low shearing forces, and does not build up on the cutting edge of the tool. These characteristics make it

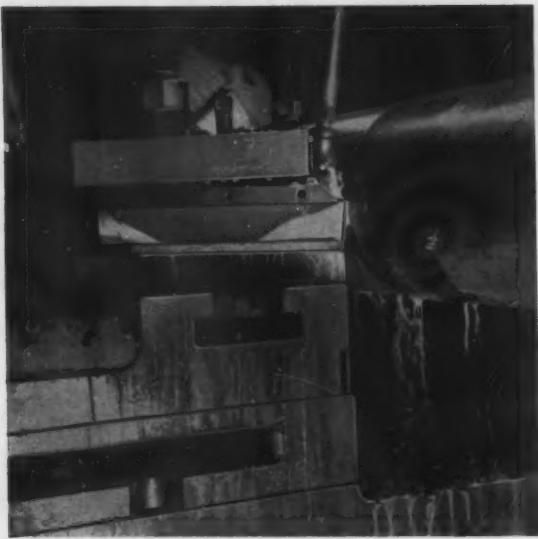


Fig. 1. Close-up view of tool under cut, showing rigid design of the lathe carriage.

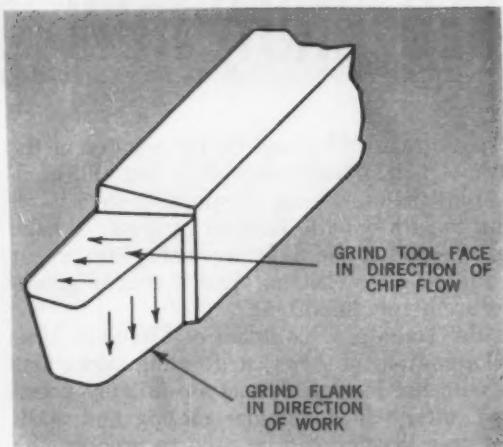


Fig. 2. To extend tool life, grinding of the face and flank should be away from the cutting edge, as indicated by the arrows.

TABLE I. RECOMMENDED ANGLES FOR TITANIUM-TURNING TOOLS, IN DEGREES

Angle	Tool Material		
	Carbide	Cast Nonferrous Alloy	High-speed Steel
Back rake	+5 to -5	0 to +5	0 to +5
Side rake	0 to -6	0 to +5	0 to +15
Side cutting edge	+5 to +25	+8 to +15	+8 to +15
End cutting edge	+6 to +10	+5 to +6	+5 to +6
End relief	+5 to +10	+5 to +7	+5 to +7
Side relief	+5 to +10	+5 to +7	+5 to +7
Nose radius, inch	0.03 to 0.045	0.02 to 0.03	0.02 to 0.03

easy to machine to a relatively fine surface finish. Because tool life is not affected nearly as much by the feed rate as it is by the surface speed, titanium is generally cut at much lower speeds than other materials, except the very difficult-to-machine nickel-based super-alloys.

One of a battery of seven 32-inch American Pacemaker lathes TMCA uses to turn the rough billets to size appears in the heading illustration. The tough scale on the forgings is a major problem, often causing cuts varying from 1/8 to 3/4 inch to be taken on the same piece. Fig. 1 is a close-up view of the cutting action.

Of all machining operations, turning probably presents the least difficulty, assuming the equipment has sufficient power and rigidity. Generally, high speeds cause failure by cratering the tool face, while low speeds produce wear on the tool flank. To extend tool life, the tool face should be ground in the same direction as chip movement and the tool flank in the direction of work movement, as illustrated in Fig. 2. Relief angles less than 5 degrees cause smearing on the flanks, while relief angles greater than 10 degrees leave the cutting edge too weak to withstand chipping.

For optimum performance, carbides should be ground with a diamond wheel without further lapping. Use of carbide tools is not recommended if any slack or wear is evident in the machine tool. High-speed steel tools should be used at lower cutting speeds and feeds. For continuous rough turning of titanium, grades C-1 or C-2 carbide are best, with cast nonferrous alloy tools and T-5 high-speed steel tools as second and third choices, respectively. For interrupted cuts or average plunge-forming cuts, T-5 high-speed steel is preferred, cast alloy is given second choice, and C-1 or C-5 carbide third. On the other hand, in severe forming, cast alloy is preferred to either high-speed steel or carbide. Recommended tool geometry appears in Table I.

Information for the turning of commercially pure and alloy titanium billets at Toronto is contained in Table II. To prevent galling and seizing, live centers are used whenever possible. For long parts of small diameter, a steadyrest or follower rest is used to keep the work from deflecting. Tools are set on dead center, and have a minimum of overhang to avoid springing and possible smearing of the flank.

High speeds are not required for good surface finishes on titanium. This is fortunate since tool life is more sensitive to speed than to any other single variable. As the strength of the titanium alloy increases, the surface speed is correspondingly decreased, while feed and depth of cut remain constant. The finish of the turned billet is so smooth that the product is wrapped in tough paper to prevent marring in transit.

TABLE II. SETUP INFORMATION FOR BILLET TURNING

Type	Rough Cut		Finish Cut
Commercially Pure Titanium	Tool*	1 1/2-inch Super Panther	1 1/2-inch Super Panther
	Depth of Cut	1/16 inch to the heavy side over ordered size	1/16 inch
	Radius	1/4 inch	1/4 inch
	Tool Angles	See Table I	
	Feed	0.040 ipr	0.035 ipr
	Speed	25 to 124 sfm	76 to 160 sfm
Alloy Titanium	Tool*	1 1/2-inch Super Panther	1 1/2-inch Super Panther
	Depth of Cut	Down to 1/8 inch oversize	1/8 inch
	Radius	1/4 inch	1/4 inch
	Tool Angles	See Table I	
	Feed*	0.080 ipr	0.035 ipr
	Speed	25 to 60 sfm	45 to 60 sfm

\*Considering all cost factors, the lower initial cost of high-speed steel tools makes their use more economical for the entire turning operation.

Since the life of any cutting tool is generally dependent on the temperature at the cutting edge, the use of the correct coolant is of great importance in any machining operation. Chemically active cutting fluids not only carry away heat, but also reduce the forces between the tool and the work, thus prolonging tool life. Because of the much higher heat-removal rate of water compared to oil, water-based fluids perform best where metal movement over the tool cutting edge is so rapid as to make special additives of no value. Coolant used for the billet turning is Hydro 48-5, which has a water-soluble paraffin base.

To reclaim the chips, it is important to prevent mixing pure and alloyed titanium, or one alloy with another. Mixed turnings, as of this date, are practically useless. Turnings are kept separate

and accumulated in appropriately marked, clean steel drums. Turnings are segregated by heat number, with only those from bars of one heat placed in a particular drum.

The most demanding problem in all phases of titanium production is that of impurities—both external and internal—which, if not eliminated or carefully controlled, could easily render the material valueless. External surface contamination is an ever-present problem during the hot-working stages. By using vacuum-melting equipment in the first stages of production, it was found that the hydrogen content of the molten titanium could be lowered considerably.

Vacuum annealing is used on in-process material to decrease hydrogen content and surface oxidation. Vacuum units with high pumping ca-



Fig. 3. An ultrasonic on-the-spot check of a turned billet being made by a member of the quality section.

Fig. 4. Billets, turned to a fine finish, are protected by tough waterproof paper prior to shipment.



pacity reduce the total time of the degassing cycle. Because gas- or oil-fired furnaces tend to yield hydrogen-producing by-products, electric furnaces are preferred where thin cross-sectional areas have to be exposed to elevated temperatures over long periods.

When minor external defects and oxidation do appear, the affected area is cleaned either mechanically or chemically. Mechanical conditioning is done by snagging or sandblasting. Chemical conditioning is done by hot caustic descaling or acid pickling. Close control of bath composition, temperature, and cycle time is necessary when pickling to prevent any hydrogen contamination. A cold-water and/or steam-cleaning operation usually follows.

So many problems are unique in working with titanium that a new approach was adopted by TMCA to provide on-the-spot control for each processing operation. The unit given this responsibility, the Process Department, is composed of a metallurgical section, a laboratory section, and a quality section.

The metallurgical section supervises all operations in which metallurgical considerations are of prime importance, including those in which temperatures must be controlled closely. It also is responsible for the establishment of basic proc-

esses and the preparation of written procedures to help the operating department turn out work correctly and uniformly.

The laboratory section is responsible for heat-treatment and for all mechanical and chemical testing in conformance with customer specifications and those established by the metallurgical section. The laboratory is completely equipped and capable of performing heat-treating operations, chemical and gas analyses, mechanical tests, and necessary microscopic examinations.

The quality section is responsible for maintaining the processes established by the metallurgical group and for final inspection of all products prior to shipment. Its responsibilities are in the areas of finish, gage, dimensions, and other physical characteristics. Members of this section examine the material after each stage, as is being done in Fig. 3, so that rejections can be made on the spot if defects in material or departure from established procedures or specifications are discovered. Emphasis placed on processing accuracy and control is so strong that 15 per cent of the floor space in the plant is devoted to laboratory facilities, and 10 per cent of the plant employees are directly engaged in quality control. Fig. 4 shows the completed billets wrapped and being readied for shipment.

# High Velocities Form Tungsten for Structural Uses

Test engineers at the Dynapak facilities of Convair Division, General Dynamics Corporation in Pomona, Calif., have developed a method of forming tungsten that promises to expand the usefulness of this metal as a structural material. Because of its high-temperature characteristics (it retains most of its strength at temperatures as high as 4000 degrees F.) tungsten has been extremely difficult to work into tough, nonbrittle shapes that would be capable of resisting sudden shocks or loads.

Tests conducted on high-velocity Dynapak extruding and forging machines have indicated that if the metal is formed fast enough, extensive grain refinement occurs, with a striking improvement in the ductility of the metal and its consequent toughness. Moreover, area reductions have been achieved that far exceed those previously obtained.

In a series of tests conducted by the National Aeronautics and Space Administration, for example, an 8-to-1 reduction was the best that could be obtained using a standard extrusion press moving at approximately 150 ipm. In order to obtain even this low level of reduction, a columbium jacket and a lubricant composed of powdered glass and graphite had to be used. With Dynapak forming (June, 1960, *MACHINERY*, page 154), by contrast, reductions up to 45 to 1 were obtained without the need for cladding or lubricant.

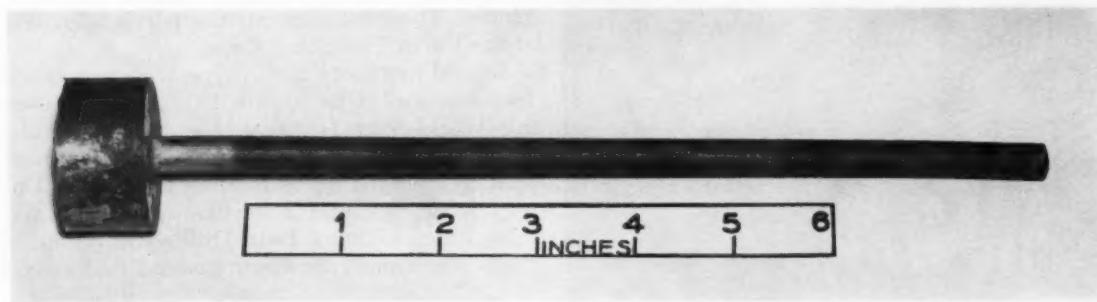
More important, from the structural engineer's point of view, was the effect on the grain structure of the metal. Tungsten billets are generally formed by powdered metallurgy techniques or, more recently, by arc melting in a controlled atmosphere. In either case, a large-grain structure

is likely to result, producing brittle lines of weakness along the grain boundaries where impurities in the metal tend to accumulate. When this weakness appears in other metals, the usual procedure is to hot-work the metal to break up the large grains and cause them to recrystallize into a finer-grain structure. The high softening temperature of tungsten has in the past made this impossible.

Low-velocity extruding simply flattens out the large grains, with no reduction in average crystal size. When subjected to high-velocity forming, however, the tungsten re-forms into much smaller crystals, breaking up the planes of weakness that might be present and producing parts of much greater ductility and toughness.

Dynapak extrusion and forging machines achieve their high-velocity characteristics through a unique application of pneumatics. The actuator unit contains two chambers, separated by an orifice plate. A comparatively low "set" pressure holds the ram piston in a cocked position against this plate, counterbalancing the 2000-psi "fire" pressure in the other chamber, which can act only against the portion of the piston exposed by the orifice opening. An O-ring around the orifice prevents the high-pressure gas from reaching the balance of the piston.

When a trigger of gas lifts the piston even a small fraction of an inch off the O-ring, the fire pressure is able to act across the entire piston area, abruptly changing the balance of forces on the piston and driving it forward with great speed. When it strikes the work-piece contained in either a forging or extrusion die, the metal moves at speeds that have never been reached in other equipment.



This tungsten extrusion was produced on a high-velocity Dynapak machine. The original billet was 1 1/4 inches in diameter and 1 1/2 inches long: the extruded portion is 3/8 inch in diameter and 9 1/8 inches long, for an approximate reduction ratio of 16 to 1.

# CUTTER GRINDING AT

KEEPING PRODUCTION type machine tools running while making special tools, cutters, and fixtures for prototype models and experimental parts is the double assignment given toolmakers at the Springfield Armory in Massachusetts. The design, tooling, and production departments of the armory not only develop new firearms but then set up pilot lines on accepted models. This puts a two-fold burden on toolroom facilities.

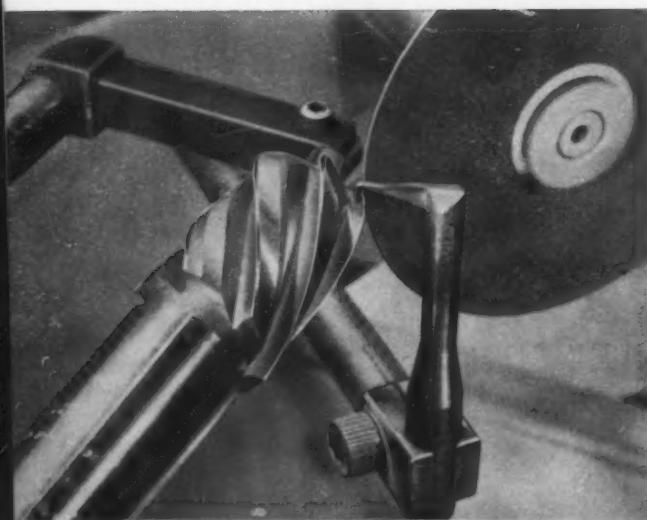
To overcome this problem, two toolrooms have been established—one devoted to making special tooling and fixturing, and the other, to sharpening tools and cutters for production type operations. In addition to making special tools for prototype-model manufacture, the tool and fixture department must keep tools ready for the machining of components for research and development projects. Tolerances are close on such parts, runs are short—sometimes only five or six pieces—and design changes are frequent.

Since the parts are usually required on short notice, there is no time to prepare official drawings, and some special tools required are made from sketches by the process engineering department. The tool- and cutter-grinding equipment employed in this department must be versatile, accurate, and capable of being set up quickly.

When small-arms weapons are standardized, the armory goes into factory type operation. The production toolroom work load is, therefore, heavy, as every kind of tool—from the smallest keyway cutter to 10-foot broaches—must be sharpened before it is actually needed. Typical cutter-sharpening setups in the armory toolrooms are here shown. The illustrations are of work being performed on a Hartex tangent-arc profile grinder. These machines are made by a subsidiary of the Union Twist Drill Co.

Several machines of this type were purchased by the armory as far back as 1938 and 1939. During World War II, when the activity at the armory increased many fold, the management realized the need for more of these grinders. Unfortunately, because of wartime regulations and commitments, Union Twist Drill could not build them. The armory, however, insisted that a need

Fig. 1. Here radii on teeth of special form cutter are being ground to blend into existing tooth contours.



# SPRINGFIELD ARMORY

existed for this particular machine; therefore an agreement was made. The Union Twist Drill Co. loaned all drawings, route sheets, patterns, and tooling to the armory as a contribution to the war effort. The armory apprentice training school solved the problem by building twelve machines. There are now twenty in use.

The extractor notch on a firing pin of an M 14 rifle must be perfectly smooth for proper operation. For this reason, the form cutter employed to mill the notch is required to have teeth with two end radii that blend into the periphery of the cutter. In addition, one radius must blend into the side of the cutter and the other must intersect the side of the cutter at a distance of 0.087 inch, plus 0.000 minus 0.002 inch, measured radially inward from the periphery. Accurate setup of the cutter on the grinder, as seen in the heading illustration, is, therefore, important.

In Fig. 1, the blending of a radius into the periphery is also a requirement. This time a form cutter with a 30-degree, left-hand helix angle is shown being sharpened. The tooth rest in this case is hooked above the tooth to guide on its face. Spindle rotation is reversed in order to keep the grinding pressure against the rest. This cutter is used in a contour-milling operation.

An example of the type of work requested of the special tooling and fixture department at Springfield, often on short notice, is illustrated in Figs. 2 and 3. A standard Woodruff key cutter is

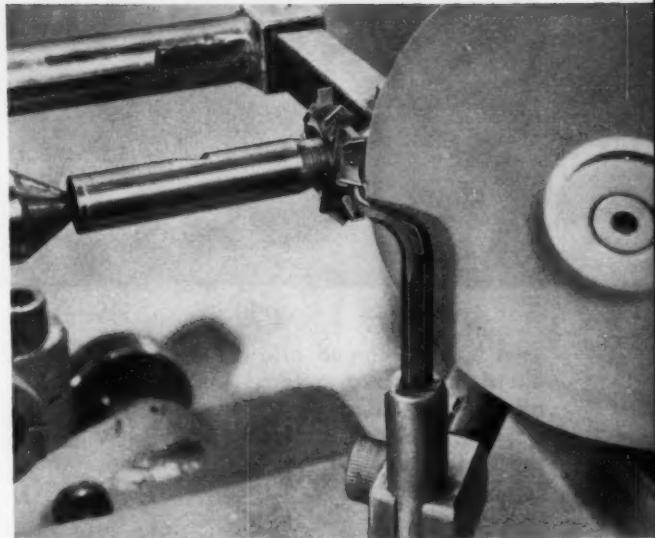
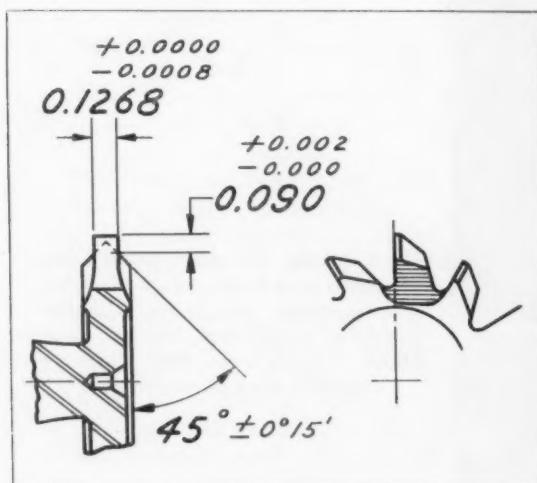


Fig. 2. Form cutter having alternate teeth of different shape being ground from a Woodruff key cutter.

Fig. 3. (Below left) Width of rectangular tooth of cutter shown in Fig. 2 is ground to tolerance of plus 0.0000 minus 0.0008 inch. Two other related tolerances must also be held.

Fig. 4. This 20-degree angle cutter, employed in the manufacture of the M 14 Springfield rifle, is typical of the majority of cutters that must be kept sharpened for pilot-line firearms development at the armory.

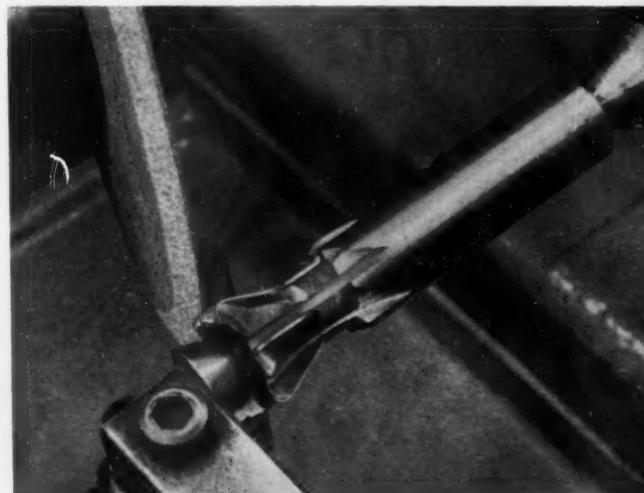




Fig. 5. These standard staggered tooth cutters are ground together and used side by side for milling a radius.

seen being reground into a form cutter having alternate teeth chamfered and the remaining teeth made square. A tolerance of plus 0.0000 minus 0.0008 inch is maintained on the width of the rectangular teeth. Thus, precision must be combined with rapid production.

Typical of the majority of cutters used in the manufacture of small arms is the angle cutter shown being ground in Fig. 4. This cutter is used to mill a 20-degree angle on a connector for an M 14 rifle. There is a tolerance of plus or minus 15 minutes on the included angle of the teeth.

Individual sharpening of cutters which in production are going to be ganged on a single arbor demands that repeat accuracies on a grinder be closely maintained. This is especially true of the cutters seen in Figs. 5 and 6, since the tolerance on the dimensional difference between the maxi-

mum diameters of the staggered tooth pair and the single cutter is plus or minus 0.0005 inch.

All Springfield Armory tool plans specify that cutting edges must be free of decarburization and wheel burn. This requires careful heat-treatment and the use of suitable grinding equipment.

Toolroom setups such as those at the armory illustrate the importance that more and more companies are attaching to tool sharpening. Formerly considered a part of overhead expense, tool grinding is now being set up in cost accounting as a direct cost item; and rightly so, because no machine tool can be any more efficient than the cutter it uses. Controlling the inventory of tools, sharpened to original manufacturers' tolerances and in sufficient quantities to keep machine down time to a minimum, is a vital factor in the production efficiency of any plant.

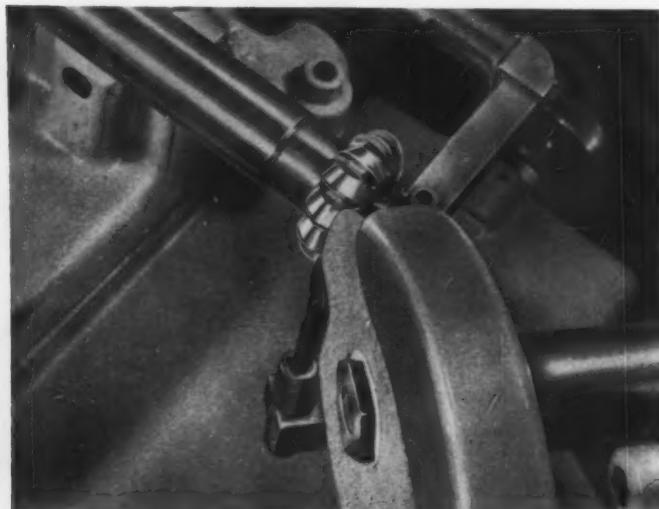


Fig. 6. In use, the radius cutter being sharpened here is ganged on the arbor with the cutters seen in Fig. 5. A difference of 0.3595 inch, plus or minus 0.0005 inch, between their maximum diameters must be maintained.

**MACHINERY'S**

*Reference Section*

# COLD-HEADING STAINLESS STEELS AND HIGH-TEMPERATURE ALLOYS

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STAINLESS STEELS and high-temperature alloys are particularly useful for fasteners and similar parts requiring high strength and corrosion resistance at both room and elevated temperatures. Components of this type are produced economically by cold-heading. Nearly all of these alloys can be cold-headed profitably, provided that the fabricator is familiar with their mechanical properties, as well as the relative adaptability of each to this process.

Those who cold-head stainless steels and high-temperature alloys, as well as fabricators employing other metal-forming operations, must solve two problems in common. The material to be worked must lend itself to the particular process without rupture; and the tools used should not chip, crack, or wear prematurely. In cold-heading, for example, imperfect wire may cause split heads resulting in rejects, and tools which break down quickly increase operating costs. Thus, the difference between good and poor cold-heading will

depend on the quality of both the wire and the tools used to work the wire.

Selection of the best stainless or heat-resisting alloy for a given application should be based on three factors: corrosion resistance, mechanical properties, and cold-headability. The relative corrosion resistance and headability of a number of grades that are often cold-headed are shown schematically in Fig. 1, and their chemical analyses are listed in Table 1.

Where good cold-heading qualities and consistent performance are desired, it is possible to have certain AISI grades made within special close analysis limits. In other cases, analyses that have been modified specially for cold-heading operations, provide a means for economically producing certain fastener designs.

The free-machining stainless steels are not generally recommended for cold-heading, although they may be slightly upset when cold. Some alloys that are ordinarily joined by welding for best

**This article is intended primarily to acquaint those engaged in cold-heading with recent metallurgical developments in the manufacture and heading of wire for applications requiring high strength and resistance to corrosion**

corrosion resistance can be used for cold-headed fasteners. Two in this category are AISI Type 316 and Carpenter Stainless No. 20 Cb, both used for high corrosion resistance.

There is an expanding new group of alloys with high-temperature strength typified by the A-286 alloy. This grade has good corrosion resistance and high strength up to 1300 degrees F. Other alloys in this group include 19-9 DL, Waspalloy, and Inconel X.

Types 321 and 347 are also being used for an increasing number of applications where corrosion and heat resistance are needed. These grades are used for aircraft fasteners that are exposed to temperatures ranging between 800 and 1500 degrees F. Their analyses are such that, at these elevated temperatures, chromium-carbide precipitation at the grain boundaries is prevented, thus guarding against intergranular corrosion.

The best corrosion resistance of all hardenable grades is provided by stainless steel Type 431. This alloy is frequently used for applications requiring good resistance to marine atmospheres, particularly in aircraft.

Types 410 and 440-C are straight chromium hardenable steels that have moderate corrosion resistance. It is important to realize that optimum corrosion resistance requires carefully regulated heat-treating procedures. Good atmosphere control is especially necessary. These grades are resistant to mild corrosives such as fresh water, the atmosphere, foodstuffs, soap, and perspiration. Type 410 is a common choice for sheet-metal screws, and the harder Type 440-C is often selected for ball bearings.

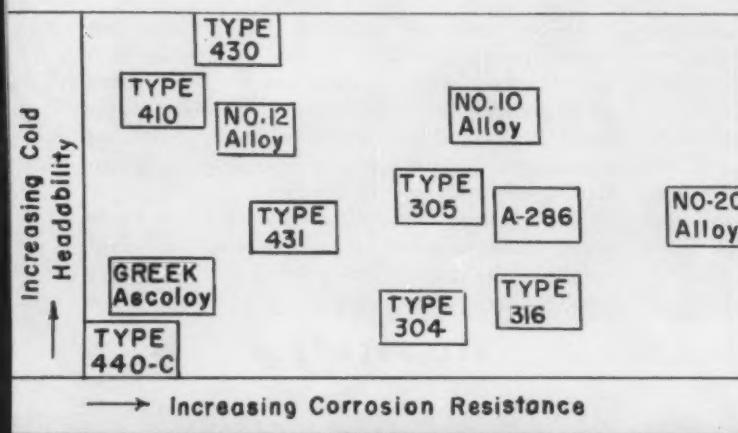
The most popular stainless steel for cold-heading is Type 430, which has excellent headability

and good resistance to atmospheric corrosion. It has fairly good strength, but cannot be hardened significantly by heat-treating or cold-working.

The austenitic or nonmagnetic stainless steels, which contain about 18 per cent chromium and 8 per cent nickel, are much more corrosion resistant than either the hardenable or nonhardenable straight chromium steels. Types 304 and 305 have similar noncorrosive qualities and are able to resist corrosion by the more severe atmospheres, nitric acid, foodstuffs, most organic chemicals, and many inorganic chemicals. For many applications, Carpenter Stainless No. 10, a grade developed for cold-headed parts, has better resistance to corrosion than Type 304. A specialty alloy also having good headability, Carpenter Stainless No. 12, offers somewhat less corrosion resistance than other austenitic stainless steels.

A chromium-nickel-molybdenum stainless steel, Type 316, has excellent corrosion resistance to pitting because of the molybdenum content. It is used for equipment designed to handle such corrosive materials as phosphoric and acetic acids, and has broad application in the chemical process industries. The most corrosion-resistant stainless steel made by Carpenter for cold-heading parts is No. 20 Cb. It offers good resistance to hot sulphuric acid, as well as phosphoric, nitric, and all the organic acids.

Every problem of corrosion involves many variables in service conditions, including temperature, aeration, and concentration. For best results in questionable applications, field tests should be made before choosing any grade of stainless for a particular use—unless there is some basis for comparing the job with one where a similar problem has been solved.



**Fig. 1. Chart showing the relative headability and corrosion resistance of a number of stainless steels and high-temperature alloys used for cold-heading.**

## Mechanical Properties

Average mechanical properties of stainless steels and heat-resisting alloys that are often cold-headed are listed in Table 2. The information given applies to material in the annealed condition, and was derived from sections heavier than wire so that a full list of properties could be obtained. As a rule, most cold-heading wire is supplied somewhat harder because of the light final draft (draw) used in making it.

The relative cold-headability of the austenitic stainless and heat-resisting steels is determined by their respective work-hardening rates. Alloys showing the least increase in hardening per given degree of cold work need less work to form them. Thus, they produce less tool wear. In Figs. 2 and 3 the relationship between tensile strength and percentage of cold work for various stainless steels is illustrated. The degree of cold work is determined from the reduction in area by wire drawing. Work-hardening rates of martensitic and ferritic grades are seen in Fig. 2 to be equal.

The annealed strengths, however, differ. For this family of alloys, the as-annealed strength (which may be exceptionally high) determines the relative cold-headability. Type 431, for instance, has a yield strength of more than 90,000 psi, which is greater than twice that of austenitic grades. This means that the header must exert twice the force for initial deformation. Experience has indicated that it is extremely difficult to head these alloys satisfactorily at tensile strengths above 140,000 psi.

Curves for the austenitic grades (Fig. 3) show that Type 305 stainless steel has a lower work-hardening rate than Types 304 and 316. The graph also indicates that Stainless No. 10 has a

lower work-hardening rate than Type 305, slightly higher than rates for the ferritic grades such as Type 430. Curves for Types 301 and 302, and a general curve for the ferritic stainless steels, are included in the graph.

If the regular 18-8 steels offer sufficient corrosion resistance, selection then depends on headability. Type 302, which is the basic austenitic stainless steel, is suitable only for those jobs involving rather simple head designs. A modified Type 304, the free-machining grade, is also available for less-severe cold-heading operations. The cold-headability of this grade is so limited that it is recommended only for making minor upsets. From the standpoint of tool life alone, Types 302 and 304 are resistant to cold-working to the point that recessed-head designs cannot be considered. Types 309 and 310, which are occasionally useful for their scale resistance, have essentially the same headability as Type 304.

Type 305, on the other hand, is recommended for many parts made in several heading stages, as well as for those having shapes requiring severe forming. Type 316 and the No. 20 alloy approach the cold-headability of Type 305. Carpenter Stainless No. 10 is an austenitic stainless steel designed specifically for making recessed-head screws, and is widely used by the fastener industry for this application.

The work-hardening rate of austenitic stainless steels is determined by chemical analysis. Nickel is generally the most important element in the composition of these steels. As the nickel content increases, the austenitic structure becomes more stable. At higher rates of cold-working, the grades with higher nickel content are less magnetic than those with lower nickel content. An increase in magnetism reflects an increase in hardness or

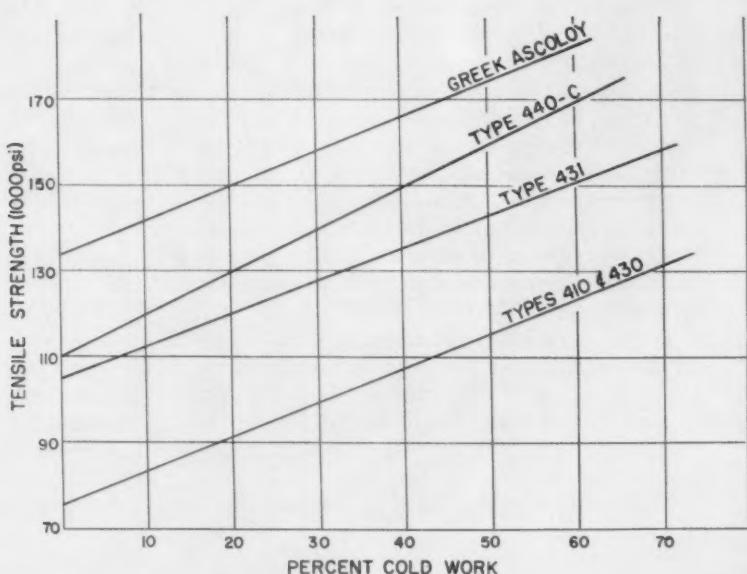


Fig. 2. Effect of cold-working on ferritic and martensitic stainless steels. Essentially equal work-hardening rates are indicated by the nearly parallel graphs.

TABLE 1. CHEMICAL ANALYSES OF REPRESENTATIVE COLD-HEADABLE STAINLESS STEELS AND HEAT-RESISTING ALLOYS

Alloy	C Max.	Mn Max.	P Max.	S Max.	Si Max.	Cr	Ni	Mo	Miscellaneous
AISI Type 410	0.15	1.00	0.040	0.030	1.00	11.50/13.50			
AISI Type 430	0.12	1.00	0.040	0.030	1.00	14.00/18.00			
AISI Type 431	0.20	1.00	0.040	0.030	1.00	15.00/17.00	1.25/2.50		
AISI Type 440-C	0.95/120	1.00	0.040	0.030	1.00	16.00/18.00		0.75 max.	
Greek Ascoloy	0.15/0.20	0.50	0.040	0.030	0.50	12.00/14.00	1.80/2.20	0.50 max.	2.50/3.50W
AISI Type 302	0.15	2.00	0.045	0.030	1.00	17.00/19.00	8.00/10.00		
AISI Type 303	0.10	2.00	0.045	0.030	1.00	17.00/19.00	11.00/13.00		
AISI Type 304	0.08	2.00	0.045	0.030	1.00	18.00/20.00	8.00/11.00		
AISI Type 305	0.12	2.00	0.045	0.030	1.00	17.00/19.00	10.00/13.00		
AISI Type 316	0.08	2.00	0.045	0.030	1.00	16.00/18.00	10.00/14.00	2.00/3.00	
AISI Type 321	0.08	2.00	0.045	0.030	1.00	17.00/19.00	9.00/12.00		
AISI Type 347	0.08	2.00	0.045	0.030	1.00	17.00/19.00	9.00/13.00		10 × % C min. Cb-Ta
Carpenter No. 10	0.08	2.00	0.045	0.030	1.00	15.00/17.00	17.00/19.00		
Carpenter No. 12	0.08	2.00	0.045	0.030	1.00	11.50/13.50	14.00/16.00		
Carpenter No. 20	0.08	2.00	0.045	0.030	1.00	19.00/21.00	24.00/30.00	2.00/3.00	3.00/4.00 Cu
A-286	0.08	1.00/2.00	0.040	0.030	0.40/1.00	13.00/16.00	24.00/27.00	1.00/1.50	1.75/2.25 T

strength, which comes from cold-working. By stabilizing the austenitic structure, there is less increase in hardness caused by cold-working. Type 305 and Stainless No. 10, for instance, are increasingly more stable than Type 304. The non-magnetic characteristics of these alloys are important for cold-headed parts demanding extremely low magnetic permeabilities.

The ultimate internal quality of cold-headed parts depends to a large extent upon the internal soundness of the steel wire from which the parts are made. Carpenter obtains this soundness in both the ingot and wire by means of a steelmaking process known as Mel-Trol. The method is based on an ingot-mold design which minimizes center segregation, produces a sound ingot center, improves cleanliness, and promotes uniformity in properties across the ingot.

The key to the improved center soundness and homogeneity across the ingot is the direction of freezing action of the molten steel after it is teemed into the mold. The metal freezes most rapidly from the bottom up, rather than from the sides to the center.

High-quality cold-headed parts can be ex-

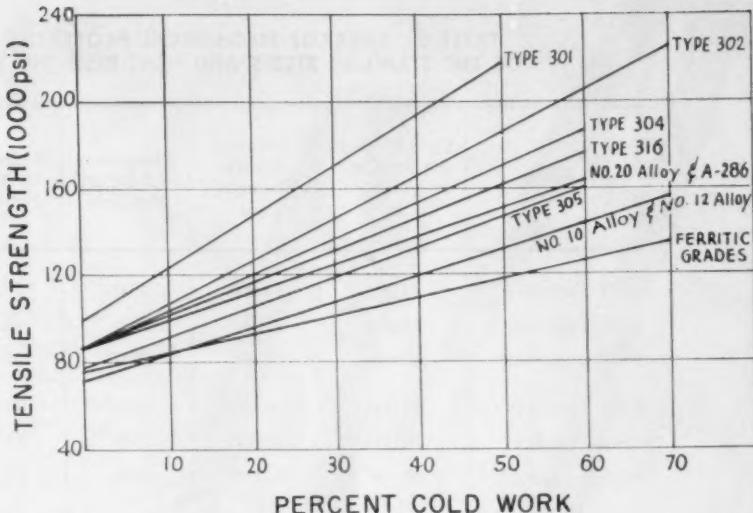
pected from the popular A-286 alloy and other grades that are produced in consumable-electrode furnaces. While such metals are frequently air-melted, consumable-electrode melting is better for minimizing nonmetallic inclusions and titanium stringers.

Internal soundness is further assured in cold-headed parts by careful billet preparation and inspection after melting. Internal nonmetallic inclusions have caused split heads on critical head designs. To safeguard against this possibility, acid-disc inspection, at the billet stage insures the best possible internal quality. The internal soundness of billets is also checked ultrasonically.

#### Wire Production

Regardless of analysis, cold-heading wire is usually annealed to a dead-soft condition when a little larger than the finished diameter. The wire is then coated and cold-drawn to final size—primarily for close dimensional control. Wire processed in this manner has low hardness but enough stiffness to permit smooth feeding into a heading machine. The light final draft elimi-

**Fig. 3. Work-hardening rates of the various austenitic stainless steels are given by the slopes of these curves. Relative ease of cold-heading is determined by the work-hardening rate of each alloy.**



nates the possibility of kinks, bends, and tangled strands. Cold-drawn wire also will generally form much better than wire that has been annealed last. Other advantages include better shearing and resistance to flattening by the feed rolls.

Experience has shown that the best coating for cold-heading stainless and heat-resisting alloys consists of a copper plate plus an application of lubricant during the final drawing process. Copper plating the wire is complicated by the fact that stainless and high-temperature alloys have a chemically passive surface film which does not permit easy preparation for adhesive plated coatings. Good pickling practice and precise control of the plating operation are essential to keep the copper coating uniform and tightly adherent.

The copper coating applied to the wire needs to be only a fraction of a mil thick. It is intended simply to keep the wire from coming in contact with cold-heading dies. Unless the wire is properly prepared, the copper coating will not adhere but tend to flake off and become useless. A bend test used to check copper adherence on plated wire is illustrated in Fig. 4. For certain applications involving severe extrusion, some benefit has been reported from heavier-than-normal copper thicknesses. Although one heading shop formerly stressed the importance of heavier copper thickness, there now seems to be a growing awareness in the same shop that copper adherence is of primary importance.

After the wire is plated, it is coated with a carrier such as lime. The carrier pulls the wire-drawing lubricant through the die during the final draw and also provides more separation between the wire and the header dies. Special lubricants are used during the draft to final wire size, depending on the cold-heading operation and the type of wire. Many parts which are ex-

truded during the cold-heading process require special lubricants and special manufacturing on mill orders.

The more popular sizes of stainless and heat-resisting alloy wire should have a seam depth confined to a maximum of 0.001 to 0.002 inch. Seam depth in relatively fine wire must be kept shallower. Larger-diameter wire may have a proportionately deeper seam. If seam depth is thus restricted, the wire can be used to cold-form even flat heads without excessive splits.

Packaging and handling coils of cold-heading wire can play an important part in the end results. Most wire is wrapped in waterproof paper with a rip cord for easy removal. The coils are either transported loose or in bundles which are easily handled by fork lift trucks. To avoid kinked strands of wire, the coils must be handled carefully and braced for shipment. Nicked and kinked wire can cause the header operator a great deal of trouble.

#### Cold-Headability Test

There is one good way to determine the cold-headability of a given coil of wire. Straighten a short piece of wire and remove a light step by machining. Then inspect for nonmetallic subsurface stringers that can lead to split heads. This method has been used successfully, but is really too cumbersome for routine quality-control.

Work is now in progress to develop a simple upsetting operation that can be used to test wire as a means of quality control. The main problem in setting up a cold-headability test is that it is extremely hard to anticipate the great variety of possible cold-heading operations. The only solution seems to lie in devising a simple cold-upset operation which can be correlated with actual

TABLE 2. AVERAGE MECHANICAL PROPERTIES (ANNEALED CONDITION)  
OF THE STAINLESS STEELS AND HEAT-RESISTING ALLOYS LISTED IN TABLE 1

Alloy	Yield Strength 0.2 Per Cent Offset, psi	Ultimate Tensile Strength, psi	Elongation in 2 Inches, Per Cent	Reduction in Area, Per Cent	Izod Impact V-notch, Foot-Pounds	Hardness	
						Brinell	Rockwell
AISI Type 410*	40,000	75,000	35.0	70.0	90	155	B 82
AISI Type 430†	45,000	75,000	30.0	65.0		155	B 82
AISI Type 431*	90,000	110,000	20.0	55.0	55	235	C 21
AISI Type 440-C*	65,000	110,000	15.0	30.0		250	C 35
Greek Ascoloy*	110,000	135,000	18.0	54.0		283	C 30
AISI Type 302‡	35,000	85,000	60.0	70.0	110	150	
AISI Type 303‡	35,000	90,000	50.0	55.0	80	160	
AISI Type 304‡	35,000	85,000	60.0	70.0	110	150	B 81
AISI Type 305‡	35,000	82,000	56.0	73.0	110	140	B 76
AISI Type 316‡	30,000	85,000	60.0	70.0	110	150	B 81
AISI Type 321‡	35,000	85,000	60.0	70.0	110	150	
AISI Type 347‡	35,000	90,000	50.0	65.0	110	160	B 84
Carpenter No. 10‡	35,000	75,000	55.0	75.0	110	130	B 72
Carpenter No. 12‡	30,000	72,000	55.0	78.0		117	
Carpenter No. 20‡	35,000	85,000	50.0	65.0	110	150	B 81
A-286**	37,000	90,000	50.0	70.0	100	160	B 85

Notes: Martensitic type structure\*

Ferritic type structure†

Austenitic type structure‡

Austenitic age-hardening type\*\*

experience. Establishment of a simple test that simulates a cold-heading operation may, however, be impractical.

### The Heading Operation

Shearing is the first step in the heading operation. It is extremely important that the cut be clean without excessive flattening or burrs, which could cause imperfections or prevent a smooth fit into the header die. Sharp tools and proper clearances are essential to good shearing.

In multiple-stage heading operations, the work-piece at the end of the first stage is known as the blank. The development of this blank is of primary importance to the quality of the final headed part. The head must remain concentric in all stages. Unless it is fully concentric during the first stages, there is great danger of the headed blank being cracked. The slightest eccentricity can cause extremely high stresses on certain por-

tions of the head, frequently resulting in compression cracks. A bad shear can lead to eccentricity and stress cracks. Imperfectly sheared slugs can bind in the floating die and prevent complete closure of the dies before upset begins. This causes buckling, which leads to eccentricity and stress cracks. Again, the same effect will result from a poor fit due to oversize wire or an undersize die. Anything which contributes to uneven metal flow during the formation of the head will possibly cause stress cracks.

The heading machine operator can save himself problems if he takes care not to apply excessive pressure on the feed rolls. It is surprisingly easy to flatten heading wire in the feed rolls. This is true particularly with the No. 10 and No. 12 alloys, which are soft and have low yield strengths. What can happen to fasteners made from wire that has been flattened in the header feed rolls is shown in Fig. 5. This condition also results from lack of travel of the moving die dur-

Fig. 4. Adherence of copper plating on each coil of heading wire is checked by this bend test. Poor plating practice caused the copper to flake off the wire at the right.

ing the development of the first stage of a recessed head.

### Warm-Heading

Warm-heading techniques used for the manufacture of fasteners give better tool wear and, at the same time, improve plasticity and headability by reducing both the strength and the work hardening of the material being formed. Temperatures involved range from 200 degrees F. to as high as 800 degrees F.; therefore very little, if any, temper discoloration results. Much greater production per die has been accomplished by warm-heading carbon, alloy, and stainless steels. The process can also eliminate stress cracks in many cases. Careful temperature control in warm-heading has been found to be very important for most grades of steel. In some instances, there is a very limited temperature range in which benefits are obtained, but recent developments in heading equipment permit very close temperature control. Surprisingly good results are acquired when temperatures under 400 degrees F are employed.

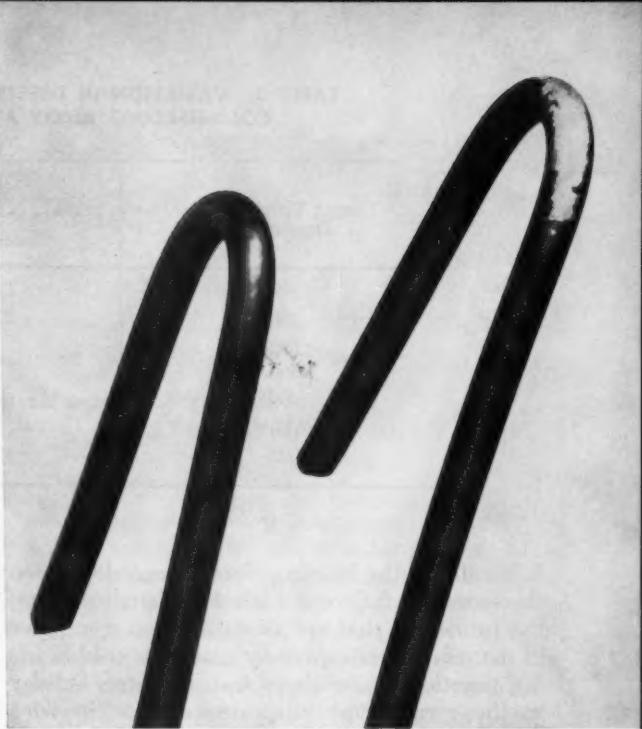
Warm-heading is recommended especially for high-strength materials, which are the most difficult to head and cause excessive tool wear. Austenitic stainless steels such as Types 302 and 305 are easier to form by warm-heading. Of course, the use of heat raises operating costs slightly.

Warm-heading is usually not necessary for grades having low work-hardening rates. However, it is conceivable that certain recessed-head designs might be formed by warm-heading with some advantages in punch life. Table 3 illustrates how the tensile strengths of annealed and lightly drawn No. 10 stainless steel are affected by heating to elevated temperatures. A lower strength and, thus, reduced resistance to forming is achieved at temperatures as low as 400 degrees F.

### Tool Life

Tool life is especially important in the manufacture of recessed head screws. Since tool wear will vary with the alloy headed, it is not safe to

Fig. 5. Too much pressure on the feed rolls may result in cracked heads. These fasteners were cold-headed from wire flattened 0.003 inch out of round by the feed rolls.



assume that the lowest-priced grade of stainless-steel wire will produce the lowest-cost cold-headed parts.

Excessive tool wear and breakage have been eliminated in the production of stainless-steel nuts by cold-heading. This operation, once considered impractical, is now accomplished economically and at high-production rates with several grades of stainless steel. In Fig. 6, the progressive steps in cold-heading two different-size nuts are illustrated. An adherent copper coating is particularly important in cold-heading nuts from stainless and heat-resisting steels, since more steps are used than for other fasteners.

Good lubricating practice is also essential to the minimization of tool wear. Proper choice of

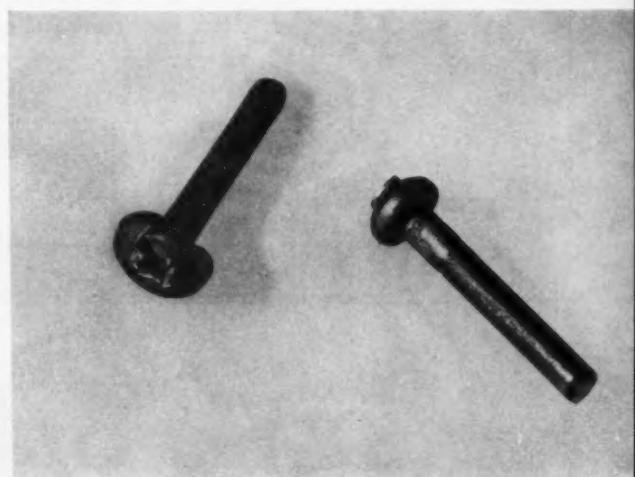


TABLE 3. VARIATION IN THE TENSILE STRENGTH OF A STAINLESS COLD-HEADING ALLOY AT ELEVATED TEMPERATURES

Testing Temperature, Degrees F.	Tensile Strength, psi	
	Annealed Wire	Lightly Drawn Wire
Room	74,250	83,200
250	67,750	
300		73,200
400		70,500
500	59,500	70,400
750	58,750	
1000	55,750	

lubricants at the heading machine can determine the success or failure of a job. Most heading shops use lubricants that are available from a number of manufacturers especially made for cold-heading practice. Many shops use lubricants similar to the grease type lubricants utilized in wire drawing. One example is a suspension of aluminum stearate in lard oil, a good boundary type lubricant for minimizing die scratches. It can be applied to the wire as it is fed into the header.

#### Fastener Design

Head design, while it is something that cannot necessarily be controlled, has an important influence on cold-headability. Typical strain patterns that occur in the cold-heading of several basic head designs are shown in Fig. 7. The patterns clearly indicate that the amount of local deformation of the cold-worked metal depends on the shape of the part. Round heads are more susceptible to stress cracking than other shapes.

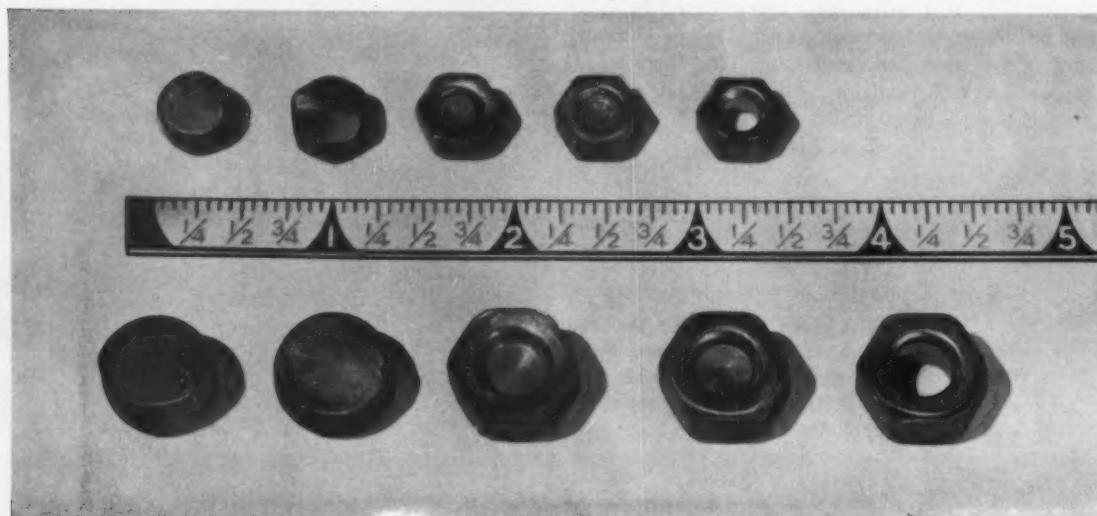
Severity of cold-heading operation can be determined by the head diameter ratio and what is

known as the free length ratio. How these ratios are calculated is illustrated in Fig. 8. The head diameter ratio indicates the amount of spreading that occurs during heading. The operation is considered severe when the head diameter ratio is 3 to 1. Slight changes in head diameter ratio can produce significant results.

The length of wire to be upset is determined by the free length ratio. Headed parts made of most alloys can be upset in one blow if their free length ratios do not exceed 2 1/4. A high free length ratio can lead to heading problems because the free stock tends to buckle, causing an eccentric blank. Experience has shown, however, that recessed heads with high free length ratios can be upset from Types 305, 410, and 430, and the No. 10 alloy by using special techniques.

Special tooling, such as a floating hammer die or spring-loaded punch, makes it possible to upset several times the theoretical minimum length in one blow. These special dies expose a free length of wire that is less than the critical 2 1/4 ratio value while the wire is being expanded into

Fig. 6. Progressive stages in the cold-heading of nuts made from a stainless alloy. Wire used for nuts should have a good adherent copper coating to prevent galling.



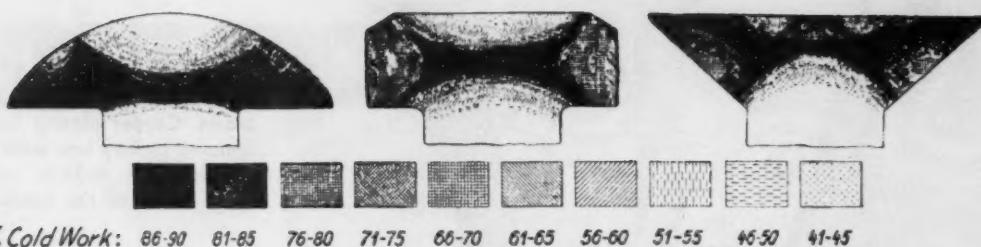


Fig. 7. Strain patterns resulting from cold-heading of three different head designs. Round heads are more subject to cracking than other shapes.

the head. The moving die receives the free end of the wire and, by means of a knockout pin, ejects the wire after the dies have closed so as to gradually form the head by feeding wire into the closed cavity between the two dies. Even with this tooling arrangement, the dies must be properly aligned to prevent formation of eccentric heads and possible compression cracks.

Another measure of the severity of a cold-heading operation is described as the heading severity ratio. This describes the degree of spreading in terms of the amount of metal in the head. A high ratio means that relatively little metal was spread out to a high head diameter ratio.

#### Passivating

Stainless steels will spontaneously form the passive oxide film which is the basis for the corrosion resistance of all high-chromium alloys. However, if the surface is contaminated in the cold-heading operation or later in heat-treating, the finished parts may be stained by the subsequent corrosion of nonstainless material. For example, a contaminated atmosphere used in bright annealing may result in some slight oxidation or nitriding, which will promote subsequent rusting. Also, the header dies, punches, and roll-threading dies—which are usually made of alloy and tool steels—will abrade an invisible smear of nonstainless steel on the surface, particularly in recessed heads and threads. Type 410, the grade which is usually heat-treated after the fastener is made, is particularly subject to corrosion from these sources if corrective action in the form of passivation is not taken. The process known as passivating can restore the natural corrosion-resistant film to all grades of stainless steel unless they have been seriously damaged by carburization or nitriding during heat-treatment.

Passivation is, for the most part, a cleaning operation to remove surface contamination. The

most simple passivating solution is one of 20 per cent by volume nitric acid in water maintained at room temperature or up to 120 degrees F. Higher concentrations of nitric acid can be used at room temperature. Immersion in this passivating solution for fifteen minutes to one-half hour is usually sufficient to remove any surface contamination except heat-treating scale, which must be removed by salt descaling and/or acid pickling. Of course, it is necessary to thoroughly degrease parts prior to passivating.

The effectiveness of a particular passivating treatment can be tested several ways. One can expose nonpassivated and passivated parts to at-

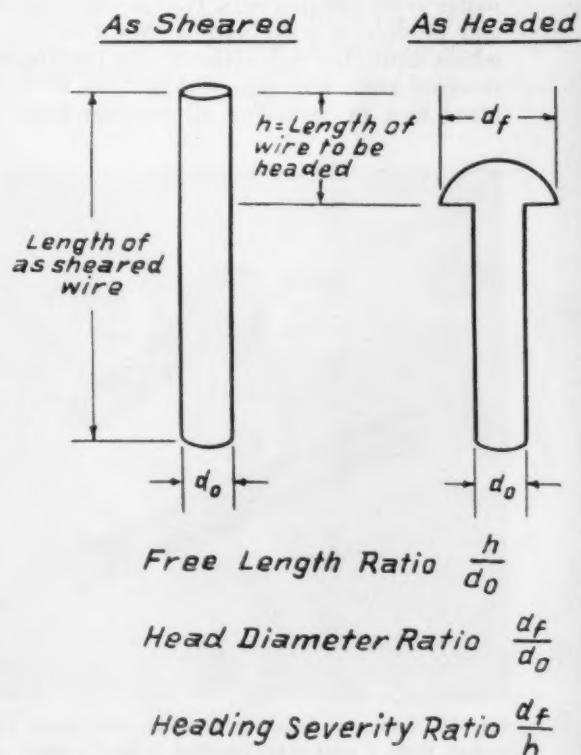


Fig. 8. Definition of three parameters important to the design of cold-headed parts and the tooling used.

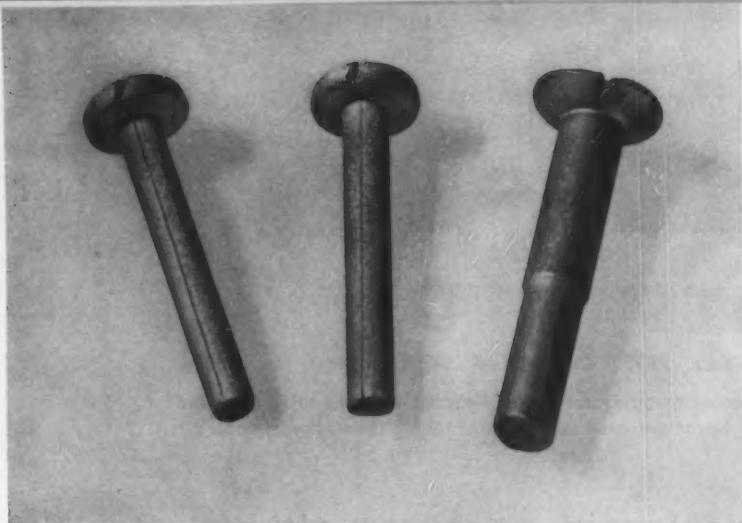


Fig. 9. Split heads caused by seams. Copper plating has to be removed to show how seams on the shanks align radially with the splits on the heads.

mospheric corrosion for a period of several days to weeks and note the difference. Nonpassivated parts will usually become stained within a few days, except in particularly dry climates. There are also chemical test procedures described in ASTM Standard A-380.

#### Possible Sources of Trouble

The machine operator can better understand some of the problems involved in heading stainless and high-temperature alloys if he is familiar with the defects encountered in headed parts. Split heads, for example, are caused by excessive seams in the heading wire. How a seam can open and produce a split head is shown in Fig. 9, which illustrates both stages in the forming of a recessed head. This type of defect can be recognized best by removing all coatings from the

headed part. The seam can be traced along the wire and up through the split, which runs parallel to the axis of the wire.

Improper tooling setups or poorly coated wire can cause scratched or galled headed parts. The tooling should be checked if scratching always occurs at the same spot on the finished product. A poor shear may cause this. Scratches may be caused by a wire coating with poor adhesion or one that has not been uniformly applied. Sometimes wire from the producer may have surface scratches from the wire-drawing dies. Scratches from wire drawing, however, rarely affect the cold-headed product. A wire-drawing scratch appears as a narrow, shallow trough rather than a line, as does a seam.

Finally, poor heading practice can cause stress cracks. As a safeguard, the heading operator should make sure that his dies are properly aligned to eliminate the possibility of forming eccentric heads. Also, the shear cut and wire diameter should be checked as mentioned previously. A cold shunt resulting from a poor shear which caused a bind in the floating first blow is shown in Fig. 10. Special care also should be taken not to apply too much pressure on the feed rolls, which might easily flatten the wire. There are many cases where the heading wire was considered defective, but the problem really came from poor techniques. Most of the time the wire can be satisfactorily headed after certain adjustments have been made.

It is easy to determine whether the heading wire is defective. All the operator needs to do is show that the suspected wire makes defective heads while other similar wire produces good headed parts on the same machine setup. The wire user does himself a real service when he helps the wire producer establish deficiencies which cause poor headability. The wire manufacturer must rely on reports from the user to upgrade wire quality and correct specific conditions when required.

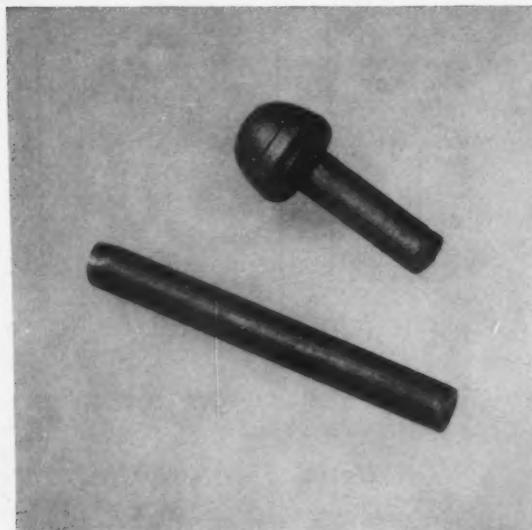


Fig. 10. Improper heading practice can cause cold shunts. Here, a poor shear resulted in double upset and circular cold shunt.

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

## Automatic Stop and Clamp for Shearing Die

FEDERICO STRASSER, Santiago, Chile

A double shearing die fitted with a combination stock stop and hold-down clamp rapidly produces narrow strips of steel of a required accurate width, and does it with a minimum amount of stock waste. The finished work-piece is 0.12 inch wide and approximately 1 3/8 inches long. There is no lateral stock allowance (a 1 3/8-inch-wide coil is used) and the bridge, or stock waste between parts, is only 0.060 inch wide.

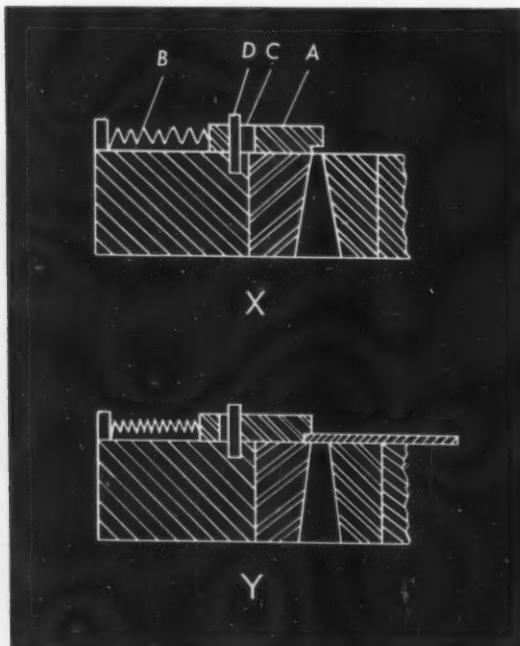
In the unloaded position of the die, View X, stop A is held forward by compression spring B, with a step in the lower front end of the stop in approximate alignment with the die-cavity wall. Two open slots C in the stop are engaged by two dowel-pins D protruding from the top of the die-block. These pins are fixed in the die-block.

When the stock is introduced, View Y, it con-

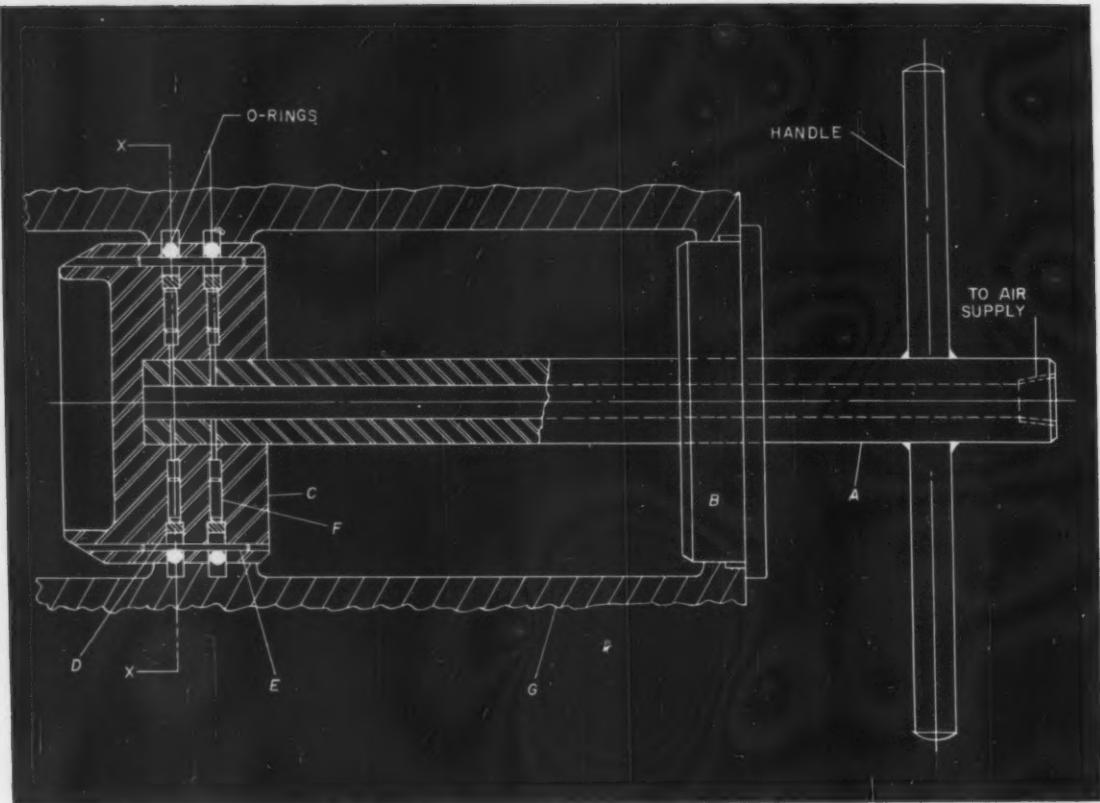
tacts the stop step, pushing the stop back. The upper end of the stop is now clear of the die cavity, and the step itself serves to hold down the work. The press can now cycle.

Each sheared-off part drops through the bottom of the die. As soon as the punch clears the die on the upstroke of the press, the stop springs forward, pushing the scrap bridge into the cavity. The stock strip can then be advanced and the die reloaded for the next piece.

Length of the slots in the stop is calculated to permit a movement of the stop of 0.060 inch—the width of the scrap bridge. Also, the distance from the step to the front end of the stop is made less than 0.060 inch, to clear the path of the punch during the press cycle. Height of the step is just slightly more than the gage of the stock.



In the unloaded position, View X, spring (B) pushes stop (A) forward until the back of slot (C) contacts dowel-pin (D); in the loaded position, View Y, the stock strip forces the stop back until the front of the slot contacts the dowel-pin.



## Tool for Assembling O-Rings in Deep Bores

WILLIAM E. WOELFEL, Chicago, Ill.

Although in most applications O-rings are assembled to the shaft, there are occasions when it is necessary to put them in a deep or inaccessible bore. For example, wet-sleeve diesel cylinder liners are usually so thin-walled that it is impossible to groove them for O-rings. Therefore, the O-rings are put in the cylinder block. The tool here described was developed and used in production for a job of this type.

The tool (Fig. 1) consists of a shaft A on which is pressed an upper pilot B and a lower pilot C. Two grooves, machined in member C, are spaced the same distance apart as the O-ring grooves in the block. The grooves in pilot C are made slightly less in width than the diameter of the O-rings in order to hold them in the pilot until installation. Four semicircular shoes D are located

at the bottom of the grooves. These shoes, which are a slip fit in the grooves, are restrained from falling out by stop-pins E.

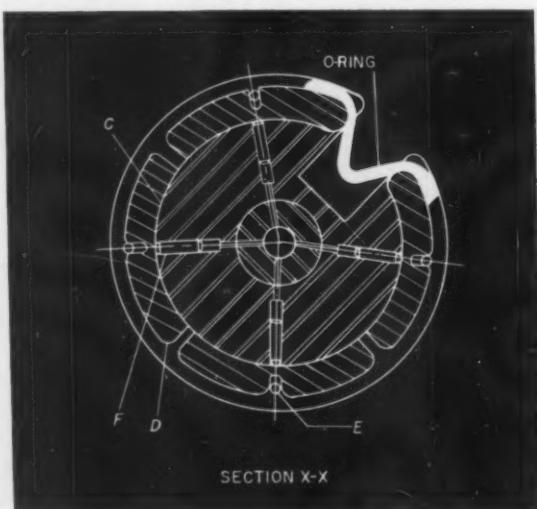


Fig. 1. (Above) Air-operated tool for installing O-rings in a deep bore.

Fig. 2. (Right) Cross section of tool seen in Fig. 1 showing how O-ring is mounted on pilot (C).

Bearing on the center of each shoe is a plunger *F* that is a close fit in a reamed hole in pilot *C*. Center shaft *A* is drilled through and tapped for an air connection, and cross-holes are drilled to allow the air to enter at the underside of plungers *F*. Also, a notch is cut through pilot *C*, as shown in Fig. 2.

To use the device, O-rings are placed in the two grooves in pilot *C* (Fig. 2) and the slack in each ring is tucked into the notch. The tool is then inserted in the bore of the work-piece *G*. Pilots *B* and *C* center the tool, and the shoulder

on member *B* stops against the top edge of the bore, thereby insuring that the O-rings are exactly opposite the grooves in the part. At this point the air is turned on and the pressure applied through the center shaft *A*, forcing plungers *F* against shoes *D*. These shoes in turn push the O-rings into the grooves in the part. The tool is rotated about one-quarter turn to "iron" the O-rings into the grooves before the air pressure is shut off and the tool withdrawn. In the setup used, the air was controlled by a foot-operated valve, thus freeing the operator's hands.

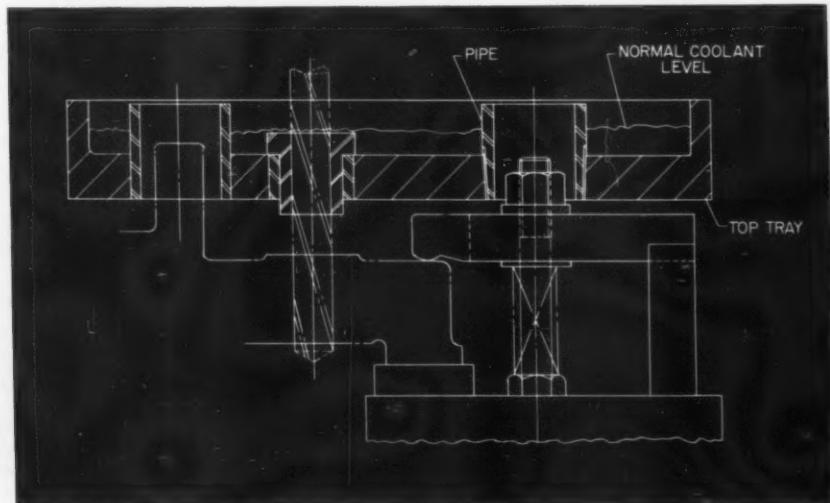
## Pipe Sections Permit Proper Coolant Flow In Drill Press Operations

ROGER ISETTS, Kenosha, Wis.

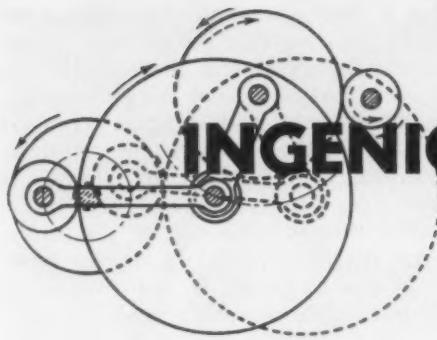
When machining parts on multiple-spindle drill presses, using jigs with tray type bushing plates, it is customary to keep a coolant lake inside the bushing plate. This is done to provide a natural passage for the coolant through the drill-bushing holes.

However, many times clamp studs, extending sections of the work-piece, or other projections make it necessary to machine openings in the

bushing plate for clearance. If that is done, the coolant will flow through those holes rather than through the bushings, as desired. A simple, inexpensive solution of this problem is to drill and tap the tray for short lengths of standard pipe at the places where such projections occur. The pipe, threaded on one end, should be long enough to extend above the top of the drill bushings as shown in the accompanying illustration.



Short pipe sections prevent improper coolant flow through necessary openings in tray type bushing plates.



# INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

## Reversing Two-Speed Geneva Drive

SIGMUND RAPPAPORT, Long Island City, N. Y.

A proposed aerial camera required a mechanism to drive a prism in a certain series of movements. Specifically, these were: (1) turn 60 degrees counterclockwise, (2) stop momentarily, (3) rotate an additional 60 degrees in the same direction, (4) pause for an instant, (5) turn back clockwise 120 degrees, (6) stop again momentarily, and then repeat the cycle. The device was to be driven by a motor having constant, uniform speed; and the transition between rest and motion had to be shock-free. The compound Geneva mechanism illustrated by the model in Fig. 1 and shown schematically in Fig. 2 was designed especially to satisfy all of these requirements.

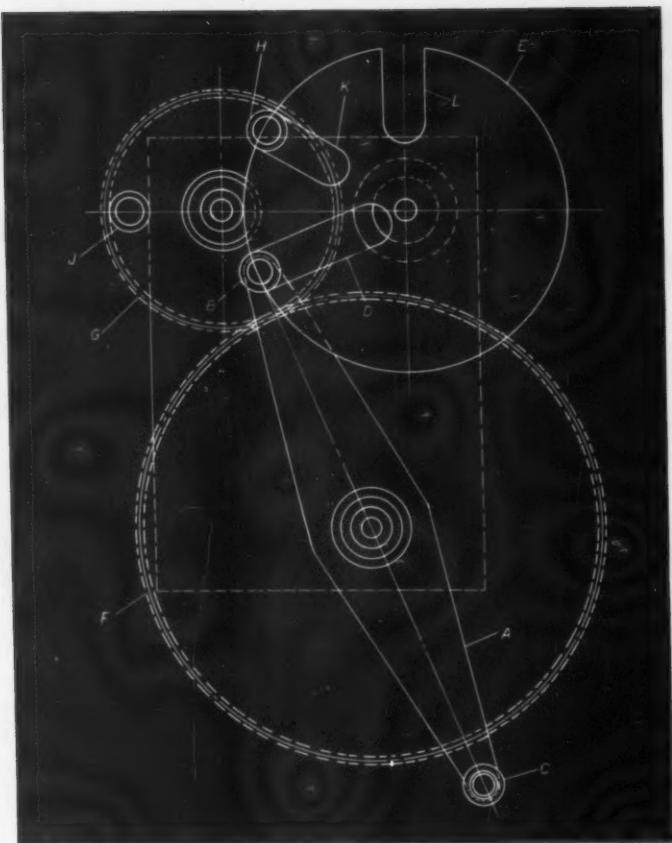
The driving member, crank A, is fastened to the input shaft. This crank carries two rollers B and C capable of entering slot D in a Geneva wheel E, which serves as the prism carrier. The length of the crank and the distance between its center of rotation and that of the Geneva wheel are such that the rollers engage and disengage slot D radially. In other words, the angle between slot D and the center line of the crank is 90 degrees at the moment of engagement. This insures smooth, shock-free operation.

Attached to crank A (and the input shaft) is a spur gear F which meshes with a spur gear G. The ratio between these two gears is 2 to 1. Gear



Fig. 1. Working model of a Geneva drive having a two-speed reversing cycle.

Fig. 2. Plan view showing details of Geneva mechanism seen in Fig. 1. Members are in position to start cycle of movements required for a prism in an aerial camera.



G carries two rollers H and J, located 120 degrees apart and capable of entering slots K and L in Geneva wheel E. The distance between the rollers H and J and the center of gear G, and the distance between the center of gear G and Geneva wheel E, are such that the rollers engage slots K and L radially. These slots are positioned 60 degrees apart on member E.

In operation, the drive starts its cycle in the position shown in Fig. 2 and crank A is rotated counterclockwise. This causes roller B to leave slot D and gear F to drive gear G clockwise. Roller H, mounted on gear G, simultaneously engages slot K and turns wheel E through 60 degrees. At this point, roller H moves out of slot K, wheel E stops momentarily, and roller J enters slot L. Once engaged with slot L, roller J turns wheel E through an additional 60 degrees. Since the gear ratio is 2 to 1, gear G has, therefore, gone through 240 degrees of rotation and crank A through 120 degrees, placing roller C in a position to enter slot D. Continued turning of crank A revolves wheel E clockwise through 120 degrees and the cycle starts anew.

No locking arcs such as those used in conventional Geneva mechanisms are necessary, since there is always one of the four rollers in engage-

ment with the wheel. This insures a positive correlation between the input and output movements at all times. The device is capable of speeds up to about 250 rpm.

• • •

## Handbook on Unalloyed Molybdenum

A new handbook provides materials engineers with comprehensive information on the properties, production, and fabrication of unalloyed molybdenum. Entitled "Molybdenum Metal," the 110-page handbook places special emphasis on new advances in arc casting and powder metallurgy which have made it possible to produce ingots up to 12 inches in diameter and to convert them readily into billets, forgings, sheet, tubing, and bars. Described also are fabrication and joining techniques which make possible the production of molybdenum metal parts on conventional equipment. Copies of the handbook are available on request from Climax Molybdenum Co., a division of the American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N. Y.

# SMALL-TOOL MAINTENANCE CENTRALIZED AT GRUMMAN

KEEPING 18,000 PORTABLE power and hand tools in repair is now a highly centralized function at Grumman Aircraft Engineering Corporation, Bethpage, N. Y. Approximately 6400 of these are portable electric tools, 7400 are portable air tools, and 4200 are various hand tools—the total representing an investment of \$1,750,000. Airframe fabrication, by nature, requires an extensive small-tool inventory.

Until recently, the tools were maintained and serviced in five separate areas of the company's sprawling physical plant. Each area had its own repair crib, spare-parts stock, and work force. No operating standards existed.

A survey by Manufacturing Engineering resulted in consolidating the areas into a Central Equipment Repair Department, and has produced a far more efficient operation. The number of men engaged in small-tool repair has dropped from fifteen to nine. Fewer spare parts are needed to maintain a working inventory; at the same time, the completeness of the inventory has reduced the waiting time for parts to a minimum.

Testing devices installed in the department include air flowmeters, torque analyzers, dynamometers, tachometers, balancers, and wattmeters. The accompanying illustrations show some of them in use.

Manufacturers of the various tools were consulted and were of considerable aid in setting up operating standards. In the case of rotary power tools, standards were established regarding power consumption (electricity or air), free-running revolutions per minute, and torque output at two-thirds of free-running revolutions per minute. Pulsating rivet setters are tested for air consumption and frequency of blows, while compression type riveters (squeezers) must pass air-consumption and force-delivered tests.

Available data indicates that tools are sent in for repair less frequently under the centralized procedure. During equivalent seven-month periods, 1246 fewer repairs on electric tools were made, and 1037 fewer repairs on air tools. The improved quality of the repair work, it is felt, has been largely responsible for these reductions.



Torque and revolutions per minute of a 1/4-inch electric drill are measured on the dynamometer. Kilowatt meter at right shows power drawn by motor.

**Checking the load pressure of a rivet squeezer on a Grumman-built piece of equipment. Above it, a flowmeter records the air consumed in cubic feet per minute.**



When a tool in service needs repair, the employe obtains a written order from his foreman which briefly describes the malfunction. The employe then delivers the defective tool and the repair order to his local tool-crib and obtains an exchange tool. This exchange tool has passed appropriate tests which prove that its performance equals or exceeds his "own." (In the past, it was observed that some workers developed an affection for a particular tool, invariably claiming that the replacement was not as good. Before tool-operating standards existed, this feeling was hard to refute.)

A pickup is made daily at each crib. When the tool reaches the repair department, it is disassembled, defective parts are replaced; then it is lubricated or otherwise maintained, and tested. Usually the tool is on its way back to the local crib the next day.

Repair records are maintained on each tool, so that those found to have chronic ailments can be discarded. The records also tell whether it is economical to perform a specific repair in terms of the working life added—that is, when a damaged tool should be replaced, and when it should be repaired. Then too, the records guide future tool purchases, by revealing which manufacturers' products have proven most trouble-free and most easy to service.

Centralizing the repair work has been so successful that the department is gradually assuming

other servicing activities. Presently, C-clamps, drill chucks, flashlights, stop countersink cages, saw bands, and file bands are items now being serviced. Inventory of saw bands has been reduced by \$20,000 in one year, and has released three men for other work.



**Repairs to motor armatures include this dynamic-balancing operation and complete electrical checks of windings as well.**

# MACHINE TOOL BUILDERS REVIEW IMMEDIATE PROSPECTS

THE MAJOR SUBJECTS considered at the Fifty-Ninth Annual Meeting of the National Machine Tool Builders' Association held at the Homestead, Hot Springs, Va., on November 2 to 4, were the recent and future Machine Tool Expositions and the present industry outlook. The retiring president of the association, Alan C. Mattison, president of the Mattison Machine Works, predicted that the last quarter of 1960 would be the best quarter, from the standpoint of new orders, that the machine tool industry has had in a long time.

Mr. Mattison pointed out that economists and business commentators are having a hard time these days deciding whether the country has been in a recession and did not know it; or whether we are in a recession right now; or whether we are headed for a recession in 1961. He attributed a lot of that talk to pre-election jitters. The Democrats tried to prove that the country is in a bad way, and Wall Street apparently has just caught up with some of the



Everett M. Hicks, newly elected president of the National Machine Tool Builders' Association

facts of life as far as earnings are concerned.

He said, "But when you keep on having an extremely high level of goods and services produced—when the nation as a whole maintains and, in some cases, increases, its actual volume of business—I don't call that a recession. What's happened is that on the whole the country has been doing a tremendous volume of business, but hasn't been making a sufficient margin of profit. I hate to use the old phrase 'profitless prosperity,' but that's a pretty good description of it.

"Now we in this industry know why profit margins have been so narrow. We know it is because manufacturing costs in the United States have been so high. We know that in many fields products from abroad, where production costs are lower, are cutting into domestic markets. We know that sooner or later industry in our country will come to the stark realization that costs must be cut, in order to meet domestic as well as foreign competition.



Francis J. Trecker—first vice-president of the association



Wallace E. Carroll—second vice-president of NMTBA



Lawrence C. Gleason—treasurer, association for 1960-1961

And we machine tool builders have what it takes to fulfill that need."

Mr. Mattison went on to say that the genuine interest exhibited by visitors at the National Machine Tool Builders' Exposition indicated that the metalworking companies of the United States are awakening to that realization right now. "If that is the case," he stated, "it will mean that the turn has come in machine tools; and that we can look forward for some time to a continuing rise in business. The potential is measured by the fact that over 62 per cent of the machine tools on plant floors of the United States are over ten years old."

### *Foreign Influence a Threat*

In reference to foreign competition, Mr. Mattison mentioned that it is an even greater potential threat to many of the industries that are customers of the machine tool industry and predicted that the threat of foreign competition may well spur them into modernization programs.

In his talk on European trade with the Soviet Union, Forrest D. Hockersmith, director, Export Policy Staff, U. S. Department of Commerce, said that our own security export controls are designed to delay and deter to the greatest extent possible the military, industrial, and war potential build-up of those areas or countries which represent a threat to our national security. He emphasized the fact that we do not possess a monopoly on the development of technology and production know-how.

We only have to look at the substantial technological accomplishments in other countries, bloc countries included, to know that we cannot permanently deny to others the benefits of technology and production progress through the simple denial of United States exports. However, we are satisfied that our economy and industrial plant enjoy a decided lead, and that through these controls that lead can be maintained and widened. Mr. Hockersmith then gave statistics showing the strides made by the Soviet bloc during the recent past in the development and production of various types of metal-cutting machine tools.

Everett M. Hicks, vice-president and general manager, machine tool division, Norton Co., and



Grayson M. Stickell—re-elected secretary of association for the coming year



Bruce F. Olson who was elected director, together with Messrs. Carroll and Gleason

the newly elected president of the association for 1960-1961, gave an address of principal interest to members. Philip A. Bennett, director of Metalworking Equipment Division, Business and Defense Services Administration, Department of Commerce, presented a report concerning the Division. In a session restricted to members of the association, a panel discussed future machine tool expositions.

An outstanding feature of the meeting was an exhibit of articles and other material developed by the trade and technical magazines that cover the machine tool industry and its customers to promote the recent exposition. Attention was directed to this display by George A. Hawkins, sales director in charge of sales promotion and market research, Brown & Sharpe Mfg. Co. Twenty-six machine tool companies received awards in a competition sponsored by the Advertising and Market Research Committee of the National Machine Tool Builders' Association.

### **New Officers Elected**

In addition to Mr. Hicks, the following officers were elected for the coming year: first vice-president, Francis J. Trecker, president of the Kearney & Trecker Corporation; second vice-president, Wallace E. Carroll, president of the American Gage & Machine Co.; treasurer, Lawrence C. Gleason, president and general manager of the Gleason Works; and secretary, Grayson M. Stickell, president and general manager of the Landis Machine Co. Directors who were elected this year are Mr. Carroll, Mr. Gleason, and Bruce F. Olson, president of the Sundstrand Corporation.

# LATEST DEVELOPMENTS

## Machine tools, unit mechanisms, machine parts, and

### Machines Developed for Microhoning Wide Range of Work

An impressive line of newly developed Microhoning machines was introduced by the Micromatic Hone Corporation, Detroit, Mich., at the Machine Tool Exposition in Chicago. Three of these machines—Model 2VB designed for honing truncated spherical surfaces, the versatile "150" machine for precision processing at relatively low cost, and the Model 5V16 long-stroke, heavy-duty vertical Hydrohone—were illustrated and described in the September Machine Tool Exposition Number of **MACHINERY**. Five other microhoning machines and a machine for milling truncated spheres preparatory to Microhoning, also introduced at the exposition, are illustrated in this article.

A new technique and the two special machines shown in Fig. 1, developed by Micromatic, have

reduced the processing of truncated spheres (from the heat-treated forging state) to two operations: spherical milling and Microhoning. The spherical milling is performed on the Model 5VMB machine shown at the right, Fig. 1, and the Microhoning is done on the Model 2VB machine shown at the left.

In both operations, the part is located on the taper and clamped in the thread, with the "ball" positioned on an inclined axis so that the center line of the ball at the crown, and the point at which the shoulder intersects the sphere, are in the same horizontal plane. (See Fig. 2).

A special Micromatic-developed cutting tool permits a constant speed of cutting action on the ball so that (in conjunction with the incline position of the part) every

point on the ball is machined at the same speed. In a thirteen-second milling cycle, 0.070 inch of stock is removed; a surface finish of around 60 micro-inches is obtained; and the sphericity of the generated work-piece is held to a 0.0005-inch tolerance.

The second, and final, operation of Microhoning employs the same fixturing technique. The final 0.002 inch of stock is removed while generating the required size, sphericity is held within 0.0003 inch, and a surface finish of 6 to 10 micro-inches is obtained. A one-piece, unobstructed spring conveyor assembly transports the work-piece from the milling machine to the loader of the Microhoning machine, thus eliminating hand transfer. This new, two-operation method of machining truncated spheres can be applied

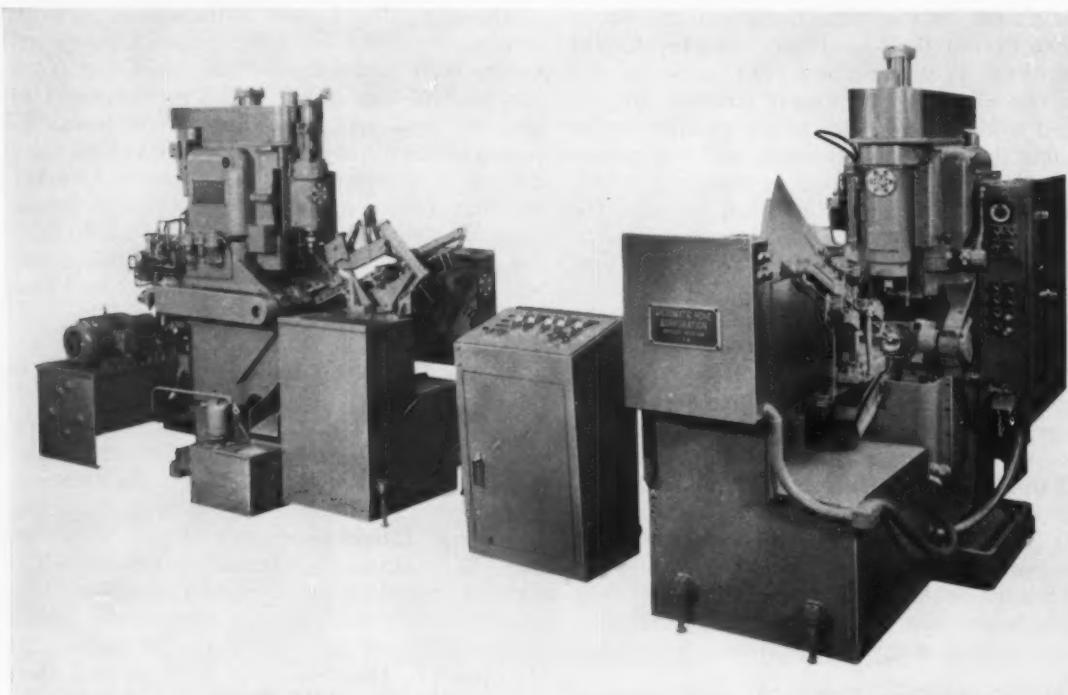


Fig. 1. Special machines developed by Micromatic Hone Corporation for processing truncated spheres

# IN SHOP EQUIPMENT

## material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

to any spherical surface so long as there is some means of holding the part without touching the spherical portion, and the heat-treatment leaves the part in a machinable state.

The mechanical-stroke, completely automated Model 738-C Microhoner, Fig. 3, has the speeds and controls required to Microhone short bores and small diameters to close tolerances at high production. It generates final functional accuracy—bore diameter, geometry, and surface finish—while maintaining the relationship of the bore to other surfaces of the part. Its fully automatic operation provides for loading, indexing, shuttling, prechecking, Microhoning, post-process gaging, segregating, and ejecting.

High and low spindle-head mounting provisions permit adaptation to long or short bores, or to parts of unusual shapes. The table has a 5-inch drop-away,

making it possible, in certain applications, to Microhone a part that is longer than the stroke of the machine.

Quick-change universal tool adapter holds tool change-over time to a minimum. Every work-piece is gaged after Microhoning for finished size, segregated, and ejected through one of three chutes according to tolerance; within, on the low side, or on the high side of the required size.

The Model 2HRI-5 machine, Fig. 4, for Microhoning inner-ring ball tracks is said to be the first to employ a newly developed method for processing and handling antifriction bearing raceway rings on a multiple-spindle setup. This machine, manual or automatic, can be built to accept a broad range of bearing sizes, with the necessary number of spindles (one, three, or five) to fit the needs of the customer.

An automatic loader assembly

designed to accommodate a range of sizes requires only replacement of individual loading tubes and pushers for different-size setups. The stone adapter and body are independent, replaceable items; therefore the same tool will accommodate several different-size stones.

The Model 5HX16 horizontal Hydrohoner, Fig. 5, was designed to combine the precision and functional surface characteristics obtained by Microhoning with the economy and high production rates of single-spindle, multiple work-piece operation. It has an index-table assembly that permits the easy adaptation of fixtures for single or multiple work-piece accommodation. With the proper fixturing, work-parts with short bores can be horizontally stacked adjacent to each other and their bores Microhoned as though they were one. Eight parts can be stacked in the Microhoning posi-

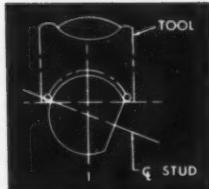


Fig. 2. Method of holding truncated sphere for milling and honing

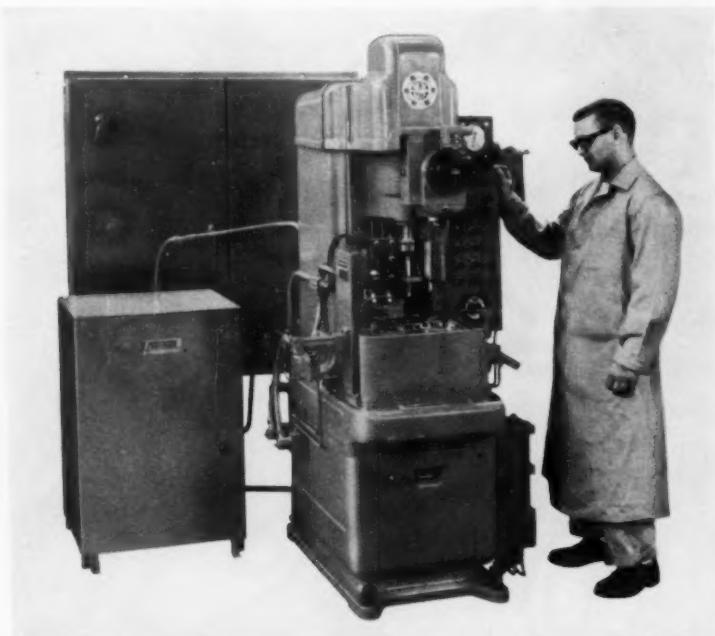


Fig. 3. Completely automated Model 738-C mechanical-stroke Microhoner

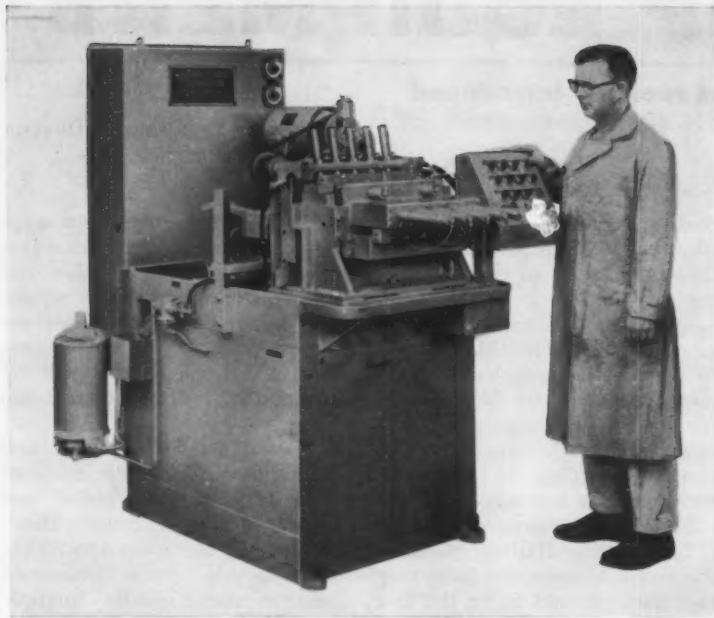
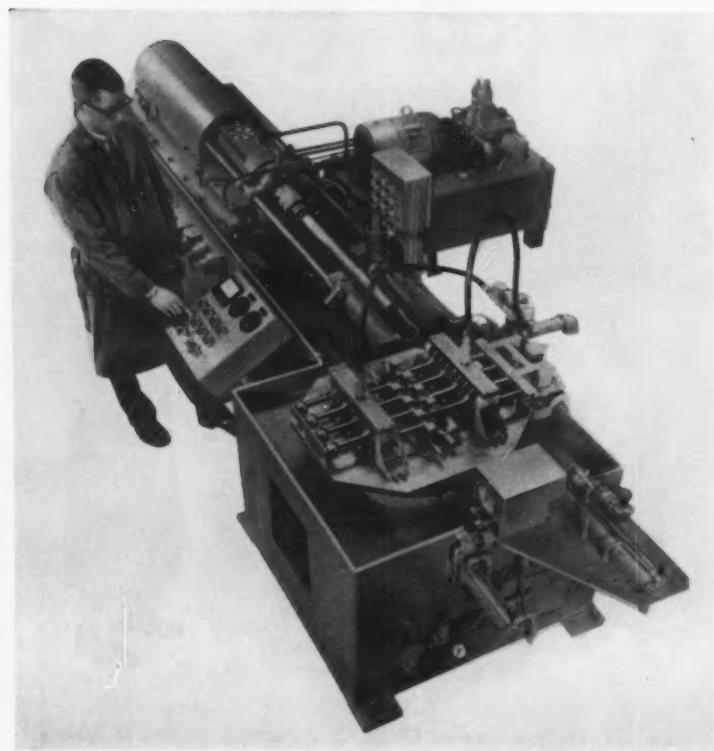


Fig. 4. Model 2HRI-5 multiple-spindle machine equipped for Microhoning inner-ring ball tracks

Fig. 5. Horizontal Hydrohoner equipped for stack microhoning work-parts held in fixtures



tion, and eight in the load-unload position. This is said to result in higher production rates of lower equipment cost, greater abrasive life with the use of longer stones, and less setup and maintenance time due to the single-spindle operation.

The hydraulically actuated spindle-in-quill feature permits rapid stock removal at close tolerances because the reciprocating weight is reduced, providing maximum input power and minimum spindle eccentricity.

The head unit has a 16-inch withdraw movement, permitting full use of the maximum 16-inch spindle stroke. This leaves ample room for complete withdrawal of the tool for table indexing or work-part removal. The transmission has three speeds which can be varied to handle a greater range of sizes and materials.

Designed for adaptation to any degree of automatic operation, the Model 2-2V3 mechanical-stroke machine, Fig. 6, is capable of Microhoning a wide variety of parts to close tolerances at high production, while generating final functional accuracy and surface finish. Work-pieces may be automatically processed through the complete Microhoning cycle: loaded, indexed, shuttled, pre-gaged, Microhoned, post-process gaged, segregated, and ejected. Pregaging assures safe tool entry; if the gage plug cannot enter the work-piece, the Microhoning cycle stops.

On this particular machine, in-process gaging is accomplished through the Jet-Matic tool: work-pieces are automatically sized along the full length of the bore. Actual inside-diameter size is indicated on dials during the Microhoning cycle, and also when the finished bore is being post-process gaged. In segregation, every work-piece is culled according to one of three finished-size categories: within the required tolerance, on the high side and on the low side.

All unload chutes discharge work-pieces to the front of the machine. A magnetic brake, which holds the head in the withdraw position at the end of the Microhoning cycle, prevents injury to

the operator or damage to tools in case of power failure. A graduated dial on handwheel permits adjustment of tool height (position) and stroke in increments of 0.001-inch.

In addition to the spindle stroke of 3 inches, this model has a 13-inch (maximum) head travel. This feature provides ample room for withdrawal of the tool and visual inspection of the work-piece. It also makes available extra fixturing capacity for parts longer than the spindle stroke. The spindle center distance of 12 inches provides generous room for fixturing large work-pieces with relatively small bore diameters.

A completely automatic setup to Microhone, simultaneously, both flat surfaces of work-parts is possible on the Model 836-2 Microflat machine, Fig. 7. In one operation, this machine generates work to close tolerances, part thickness, parallelism, surface flatness, and with the required finish. The work-carrier assembly accepts parts from the loader and feeds them between the abrasive discs. Abrasive-wear compensation assembly makes adjustments for the wear of the discs, and controls the thickness of the work-pieces through a feedback signal from the air gage which is constantly measuring the parts for size.

As the work-pieces are discharged from between the abrasive discs, they pass through a built-in air gage that measures them for thickness and indicates their size on a dial. Speeds of the unload conveyor are synchronized with the work-carrier through mutual drive of one motor. All fittings are lubricated from one central reservoir.

The machine stops immediately when the abrasives are worn down, or when the carrier plate jams or is improperly loaded. A rigidly mounted diamond dresser is supported at both ends to minimize deflection. It can dress both discs quickly and safely in one operation. There is an adjustable abrasive-disc speed control. A hand knob is provided for changing speed through a speed-selector variable drive.

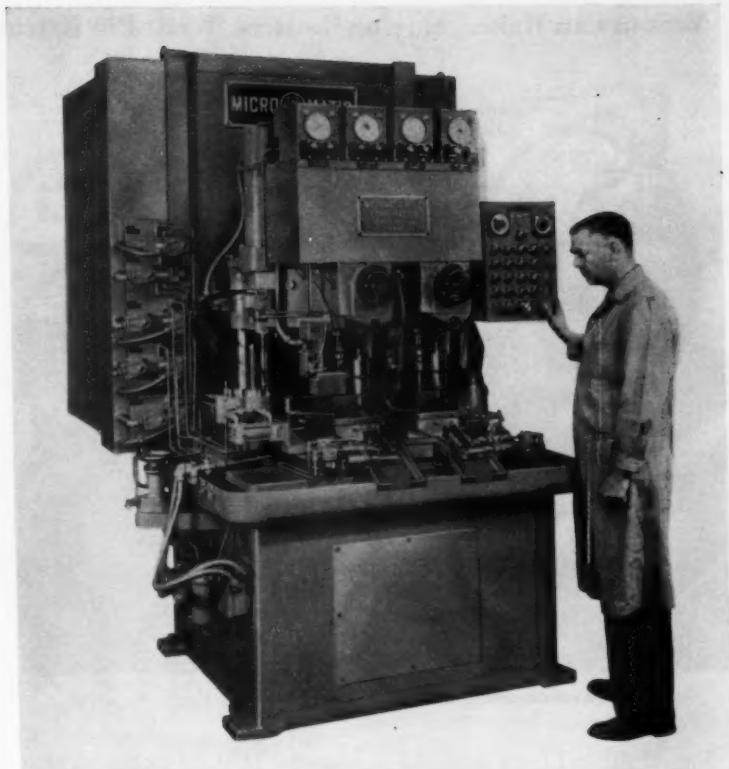
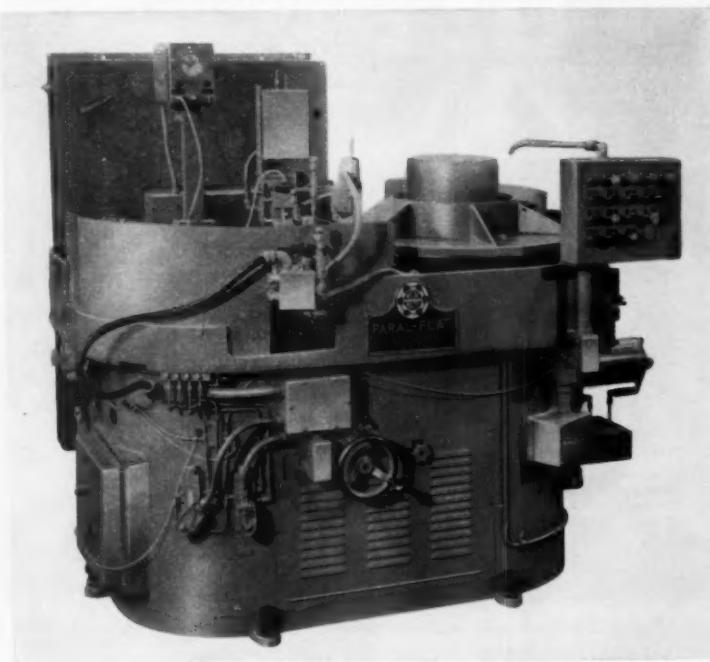


Fig. 6. Microhoner Model 2-2V3 designed for any degree of automation

Fig. 7. High-production Microflat machine designed for simultaneous Microhoning of both flat surfaces of work-parts



Circle 565 on Readers' Service Card

## Verson Can Maker, Moving Bolsters, Wrist-Pin Extruder, and Press-Brake Drive

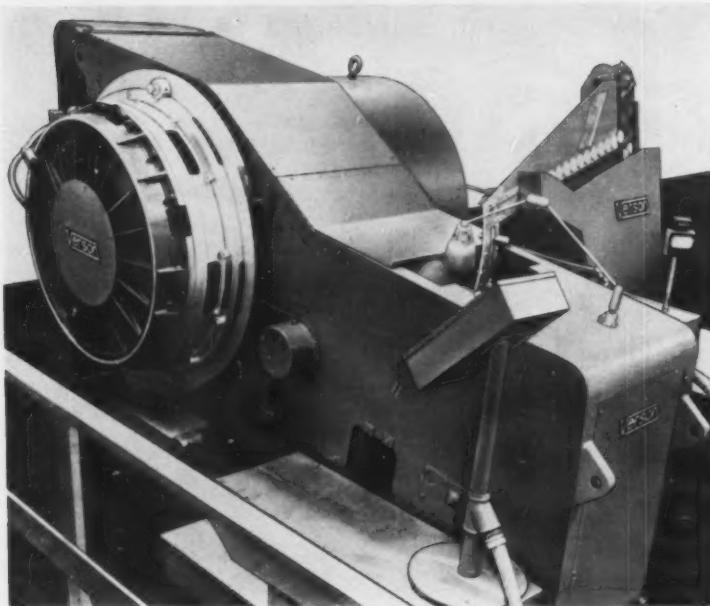


Fig. 1. Extrusion press rapidly converts aluminum slugs into cans

Verson Allsteel Press Co., Chicago, Ill., has recently announced a moderately priced, horizontal extrusion machine, Fig. 1, for the manufacture of aluminum cans and containers. It is designed to operate at more than 200 strokes per minute, extruding the can in a single stroke from a 2.6-inch-

diameter by 0.164-inch-thick slug.

The can is completely formed except for the rolling of the lip, which is done in a separate machine. The machine is rated at 400 tons and utilizes a hopper feed. It is expected that the press will find extensive use wherever canners wish to combine the advan-

tages of aluminum with the economy and convenience of making cans on their own premises.

The 600-ton, two-point eccentric press, Fig. 2, incorporates a simplified type of moving bolster assembly which is claimed to provide the convenience of a quick die change at a cost lower than other arrangements available. The assembly can be furnished as either a single- or double-moving bolster unit.

In a single unit, the bolster is mounted on a self-contained carriage which moves on trolley type wheels over tracks on a table extending from one side of the press. The carriage is driven by a direct-current motor and separate gear reducer which slow the motion of the bolster as it approaches positive stops. Once in pressing position, hydraulic cylinders under the trolley wheels lower the bolster to rest firmly on the bed. For a tooling change, the hydraulic cylinders raise the bolster until the wheels are at the level of the extension table; and then the drive moves the bolster out on the table, where it is easily accessible.

Double units utilize extension tables on both sides of the press and have carriages with bolsters connected in tandem. While one bolster is in pressing position, the other bolster is on the extension table where tooling changes can be made.

A double transfer-feed mechanism has been applied to a cold extrusion press, Fig. 3, developed to produce automotive wrist-pins from solid slugs of metal. From a single hopper, the slugs are fed to two Transmat mechanisms. The material is moved to each station by mechanical fingers in parallel transfer operations.

Starting with the precoated slug, 0.941 inch in diameter by 1 3/8 inches long, the material is checked for size at the first station, and extruded at the second. The third station draw-wipes and pierces, and the part is unloaded through the bottom of the die. The finished wrist-pin has an outside diameter of 0.866 inch, in-



Fig. 2. Double-bolster assembly permits new die setups to be made on idle bolster while press operates

side diameter of 0.541 inch, and length of 2.795 inches.

To answer the need for higher production rates for its press brakes, Verson has announced a dual-speed drive. It advances the ram at a rapid speed and then slows it down prior to contacting the work. This will permit higher production without the inconvenience and danger brought on by high forming speeds when bending large sheets.

The slower forming speed also slows the travel of the end of the sheet as the bend is being made. Return of the ram is at the higher speed. The dual-speed drive is available on all of the company's larger press brakes.

Circle 566 on Readers' Service Card

### DoALL Cutoff Saws with New Power Drive

Drive systems with 60-per-cent greater power have been added to the combination of high-speed saw band and heavy-duty band machines for cutoff applications

introduced in 1953 by the DoALL Co., Des Plaines, Ill. To assure adequate power for the constantly increasing applications of this line of cutoff equipment, the

new models will have a 5-hp drive system, Fig. 1. This is particularly important because of the new saw bands being developed.

The 5-hp drive consists of a new concept of motor mounting plus redesigned variable-speed drive, cutting head pivot assembly, and spindle assembly. The new drive is especially designed to assure trouble-free, low-cost maintenance. The motor has a unique mounting that provides positive, constant-force belt tension which prolongs belt life. The 5-hp motor is mounted on a chassis that travels on ball-bearing ways. The long spring maintains the proper tension on the belt with less than 2-per-cent variation throughout the working range. It is adjusted by two easily accessible jam nuts. The width of the belts has been increased to 1 7/16 inches to assure long, efficient service.

The end sheaves in the variable-speed drive are keyed to a super-finished sleeve. The speed-change sheave that rides on the sleeve has a Fabroid bearing. This consists of a steel sleeve faced with fiberglass and Teflon.

The new variable-speed drive has a number of other features. For rigidity, all shafts are supported at both ends, Fig. 2. The speed-change hydraulic cylinder acts along the center line of the drive and has been increased in

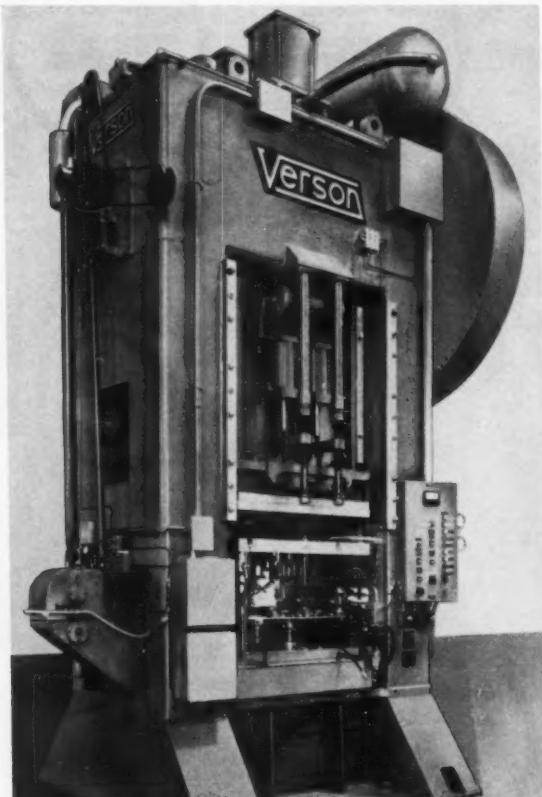


Fig. 3. Impact press for extruding wrist-pins from solid slugs has two transfer-feed mechanisms

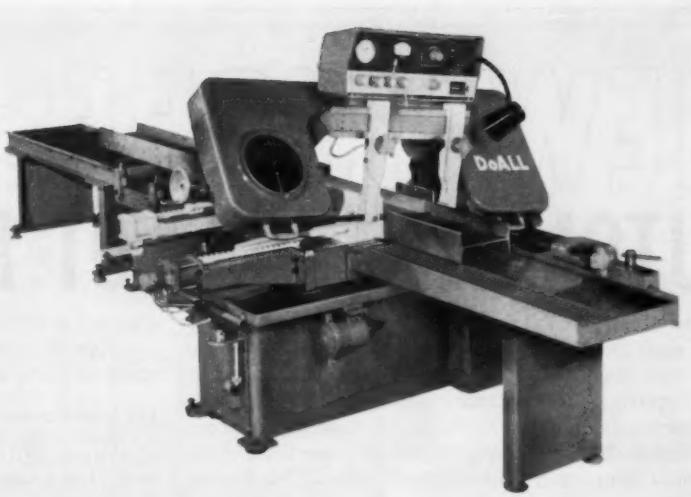


Fig. 1. DoALL power saws, Models C-69 and C-70, with power drive system

# NEW HUGHES MT-3 AUTOMATES JOB LOT PRODUCTION

The new Hughes MT-3 replaces from three to six conventional machines. It drastically reduces costs by bringing production line efficiency to small lot manufacturing of parts requiring face and other milling operations, drilling, boring, reaming and tapping. Operating from numerical instructions programmed on tape, the system functions completely automatically. The MT-3 has an

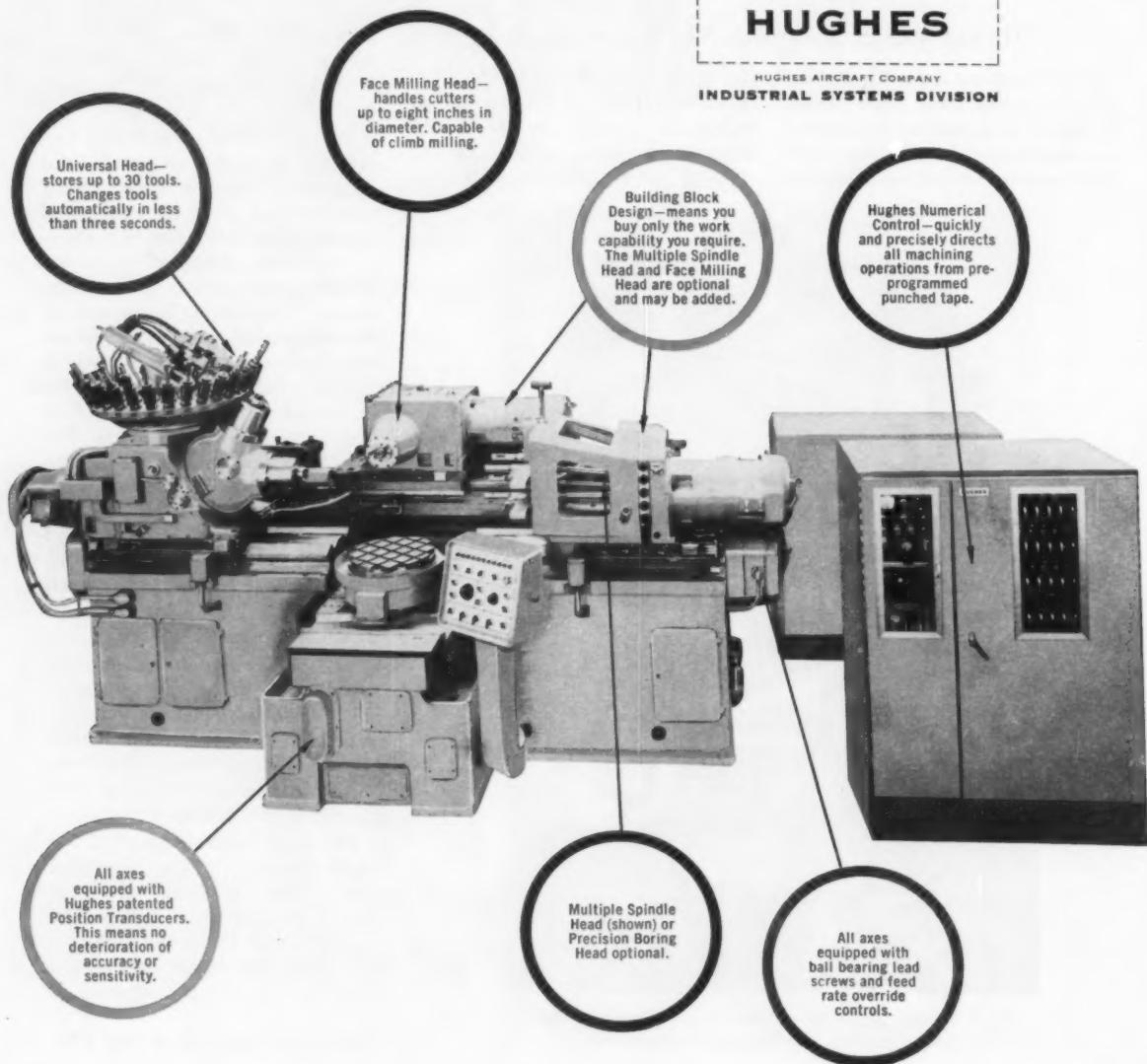
absolute positioning accuracy of  $\pm 0.0005$ ". Its part size envelope is a twelve-inch cube, but in many cases will machine parts up to 12" x 24" x 24".

For complete engineering specifications, firm price and delivery dates write, teletype (TWX INGL 4117) or call collect: HUGHES INDUSTRIAL SYSTEMS DIVISION, P. O. Box 90904, Los Angeles 45, California.

CREATING A NEW WORLD WITH ELECTRONICS

**HUGHES**

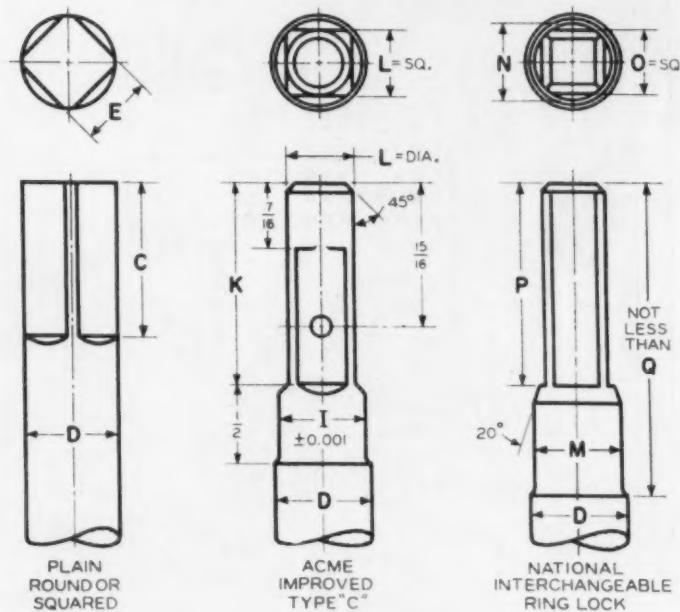
HUGHES AIRCRAFT COMPANY  
INDUSTRIAL SYSTEMS DIVISION



# MACHINERY'S DATA SHEET

## AMERICAN STANDARD CUT AND GROUND THREAD TAPS—25

### Tapper Tap Shanks



### General Dimensions

Diameter of Tap	Dimensions										
	C	D	E	I	K	L	M	N	O	P	Q
1/4	5/16	0.185	0.139	0.177	1 1/16	0.147	0.185	0.170	0.134	11/16	2 1/2
5/16	3/8	0.240	0.180	0.232	1 1/16	0.188	0.240	0.221	0.165	11/16	2 1/2
3/8	11/16	0.294	0.220	0.286	1 1/16	0.240	0.290	0.271	0.208	11/16	2 1/2
7/16	3/4	0.345	0.259	0.336	1 1/16	0.290	0.340	0.320	0.240	11/16	2 1/2
1/2	7/8	0.400	0.300	0.390	1 1/16	0.320	0.400	0.374	0.286	1	3 1/4
5/8	7/8	0.450	0.337	0.446	1 1/16	0.350	0.450	0.422	0.318	1	3 1/4
3/4	15/16	0.503	0.377	0.500	1 1/16	0.390	0.500	0.450	0.350	1	3 1/4
7/8	1	0.616	0.462	0.610	1 1/16	0.480	0.615	0.540	0.422	1 5/16	3 1/4
1	1 1/16	0.727	0.545	0.722	1 1/16	0.540	0.720	0.630	0.500	1 5/16	3 1/4
1 1/16	1 1/4	0.834	0.625	0.829	1 1/4	0.650	0.825	0.730	0.574	1 5/16	3 1/4
1 1/8	1 1/4	0.933	0.700	0.929	1 1/4	0.710	0.930	0.855	0.667	1 1/4	4 1/2
1 1/4	1 5/16	1.058	0.793	1.053	1 1/4	0.780	1.055	0.975	0.760	1 1/4	4 1/2
1 1/8	1 3/8	1.153	0.865	1.149	1 1/8	0.850	1.150	1.055	0.824	1 1/8	4 1/2
1 1/2	1 1/2	1.278	0.958	1.269	1 1/2	0.950	1.275	1.195	0.917	1 1/2	4 1/2

All dimensions are given in inches.

### Tolerances

Element	Range	Direction	Tolerance	
			Cut Thread	Ground Thread
Length of Square	1/4 to 5/16 incl.	Plus or Minus	1/32	1/32
	5/16 to 1 1/2 incl.	Plus or Minus	3/64	3/64
Size of Square	1/4 to 1/2 incl.	Minus	0.004	0.004
	5/16 to 1 incl.	Minus	0.006	0.006
	1 1/8 to 1 1/2 incl.	Minus	0.008	0.008

All dimensions are given in inches.

Extracted from American Standard Taps—Cut and Ground Threads (ASA B5.4-1959), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

# MACHINERY'S DATA SHEET

## AMERICAN STANDARD CUT AND GROUND THREAD TAPS—26

### Fractional Size Taps

Ground Thread—Unified and American Form

Size	Threads per Inch			Major Diameter			Thread Limits													
							L1 Limit		Basic		H1 Limit		H2 Limit		H3 Limit		H4 Limit		H5 Limit	
	NC	NF	NS	Basic	Min.	Max.	Min.	Max.	Pitch	Diam.	Min.	Max.								
20	28	..	..	0.2500	0.2540	0.2550	0.2175	0.2175	0.2175	0.2180	0.2185	0.2190	0.2185	0.2283	0.2283	0.2288	0.2288	0.2200	0.2200	
18	24	..	..	0.3125	0.3125	0.3125	0.2535	0.2535	0.2268	0.2268	0.2273	0.2273	0.2278	0.2278	0.2279	0.2279	0.2274	0.2274	0.2277	0.2277
16	24	..	..	0.3750	0.3800	0.3810	0.3339	0.3339	0.3344	0.3344	0.3349	0.3349	0.3354	0.3354	0.3359	0.3359	0.3359	0.3359	0.3364	0.3364
14	24	..	..	0.4375	0.4375	0.4375	0.4435	0.4435	0.3790	0.3790	0.3479	0.3479	0.3484	0.3484	0.3489	0.3489	0.3494	0.3494	0.3499	0.3499
12	20	..	..	0.4938	0.4938	0.4938	0.4425	0.4425	0.3906	0.3906	0.3911	0.3911	0.3916	0.3916	0.3921	0.3921	0.3926	0.3926	0.3931	0.3931
10	18	..	..	0.5625	0.5625	0.5625	0.5065	0.5065	0.4425	0.4425	0.4500	0.4500	0.4505	0.4505	0.4510	0.4510	0.4515	0.4515	0.4520	0.4520
8	16	..	..	0.6320	0.6320	0.6320	0.5700	0.5700	0.5084	0.5084	0.5089	0.5089	0.5094	0.5094	0.5099	0.5099	0.5104	0.5104	0.5109	0.5109
6	14	..	..	0.6750	0.6750	0.6750	0.5680	0.5680	0.5264	0.5264	0.5269	0.5269	0.5274	0.5274	0.5279	0.5279	0.5284	0.5284	0.5289	0.5289
4	12	..	..	0.7500	0.7500	0.7500	0.6560	0.6560	0.5660	0.5660	0.5665	0.5665	0.5670	0.5670	0.5675	0.5675	0.5680	0.5680	0.5685	0.5685
2	10	..	..	0.8750	0.8750	0.8750	0.8835	0.8835	0.7550	0.7550	0.7560	0.7560	0.7565	0.7565	0.7570	0.7570	0.7575	0.7575	0.7580	0.7580
1	8	..	..	1.0000	1.0000	1.0000	1.0065	1.0065	0.8820	0.8820	0.8826	0.8826	0.8826	0.8826	0.8829	0.8829	0.8833	0.8833	0.8838	0.8838
1	..	..	..	1.0000	1.0000	1.0000	1.0075	1.0075	0.9188	0.9188	0.9193	0.9193	0.9198	0.9198	0.9203	0.9203	0.9208	0.9208	0.9213	0.9213
1	..	..	..	1.0000	1.0000	1.0000	1.0070	1.0070	0.9536	0.9536	0.9541	0.9541	0.9546	0.9546	0.9551	0.9551	0.9556	0.9556	0.9561	0.9561

All dimensions are given in inches.

Extracted from American Standard Tap—Cut and Ground Threads (ASA B5.4-1959), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.



## **Tapping Heads 10 and 11 Operational**

On this 23 station Greenlee automatic transfer machine being built for a prominent truck maker to machine cylinder heads, GREENFIELD taps were on the job way back here during test runs on the assembly floor.

When buying machine tools, it's smart to choose a reliable tool supplier to work along with your machine builder. Then you'll know on delivery that your tools as well as the machine are truly operational.

**GREENFIELD TAP & DIE** GREENFIELD, MASS.

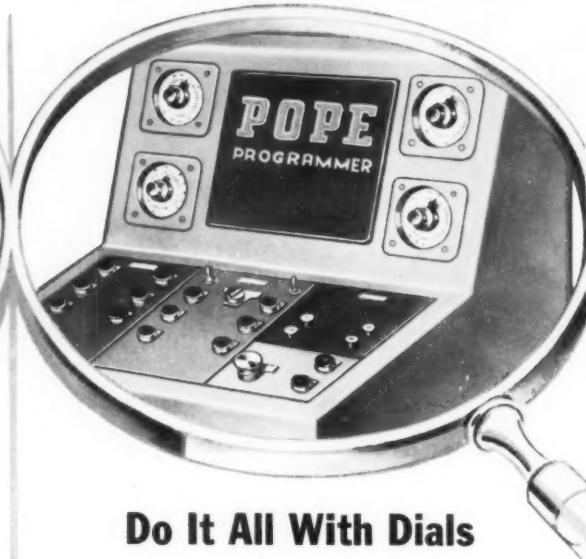
# YOU CAN INCREASE PROFIT AND PRODUCTION with this new **POPE 10-6** SUPER-PRECISION BORING MACHINE



## Two Heads Are Better Than One

and of course you can have more than one spindle in each head. The Pope Model 10-6 features *two precision boring heads\** operating completely independently of each other to provide simultaneous or alternate cycling movement of the heads. *This means increased production.*

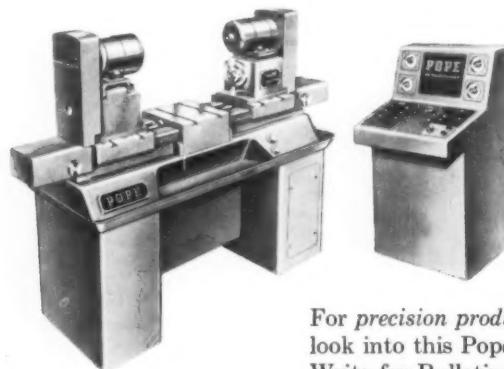
\*The Pope Boring Head Spindles on this machine revolve within 20 Millionsths.



## Do It All With Dials

Automatic cycles for boring operation sequences are programmed on these dials. The operator simply determines the sequence of operations and dials each one. You get continuous production of uniform parts in less time.

The Pope Electric Programmer gives you finger-tip fast control of infinitely variable speed, distance and operating sequence. You dial in the complete program with ease and speed that beats expensive numerical or tape control. Constant accuracy is maintained for cycle after cycle.



- Table dimensions—12" x 12"
- Maximum stroke, each head —6"
- Standard center height—  
5½" (variable)

No. 132

For precision production at a profit  
look into this Pope Model 10-6.  
Write for Bulletin S-21.



**ENGINEERS, DESIGNS AND BUILDS  
PRECISION ANTI-FRICTION BEARING SPINDLES  
FOR EVERY PURPOSE**

**POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.**

**Established 1920**

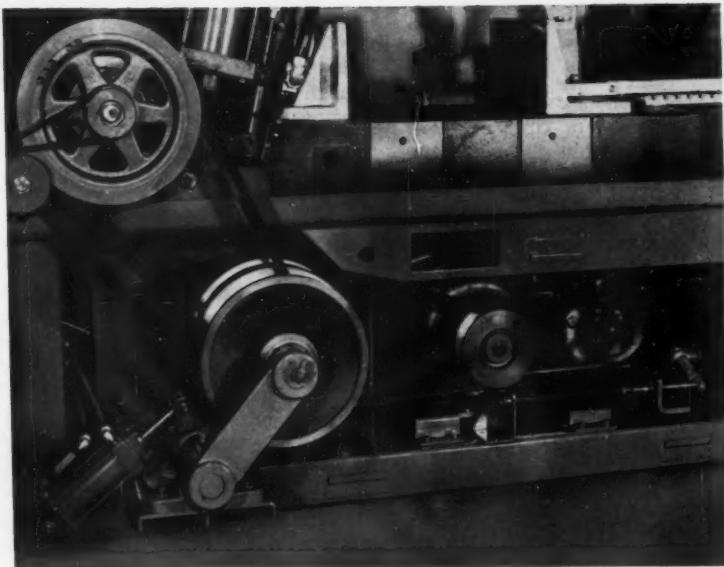


Fig. 2. Variable-speed drive of DoALL power saws that provides a band speed range of 50 to 350 fpm

size. Speed changing is therefore accomplished without bending or turning moments. The drive ratio is 6 to 1, providing band speeds from 50 to 350 fpm. To distinguish these machines from their

predecessors, they have new model designations. Model C-69 has an automatic cutting-head cycle but manual work indexing. Model C-70 is fully automatic.

Circle 567 on Readers' Service Card

### Ther-Monic Machine Facilitates Oil- and Water-Quench Hardening

The flick of a selector switch, which in turn selects the desired

operating frequency, makes it possible to perform hardening appli-

cations at high or low frequencies in a new Ther-Monic machine designed by the Induction Heating Corporation, Brooklyn, N. Y. The new unit has a three-position work station, and it will cover almost any type of application requirements. It is equipped with a two-position low-frequency and a single-position higher-frequency output. Also it has dual facilities for oil- and water-quench mediums used for hardening applications and can be used as a reservoir for oil- or water-recirculating systems.

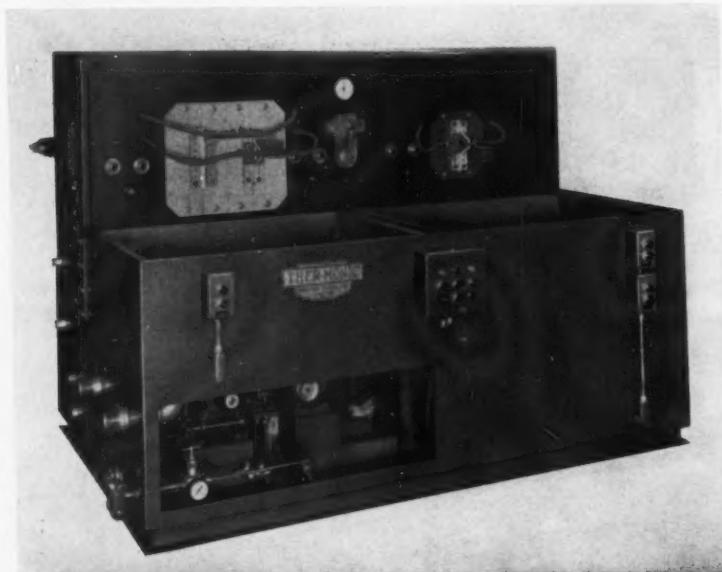
The left side of the table has a pop-up spindle for rotating, raising, or lowering the work in and out of the heating section. The spindle can be used on both the low and high frequencies. Other outstanding features include: oil-recirculating system (not shown) equipped with stainless-steel sinks, electrical adaptation to run either oil or water on whatever station is required, and an indicating timer that determines heat or quench cycles automatically. Manual buttons individually select and check the various quench or heat cycles that may be required before starting or during operation. A complete safety interlock insures safety of operating personnel and of the equipment itself.

Circle 568 on Readers' Service Card

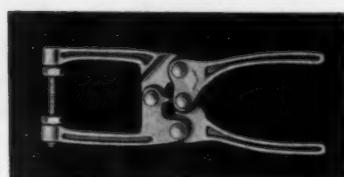
### Wespo Toggle Plier

Model 505 toggle plier recently added to the Wespo line of pliers introduced by the Wespo Division, Vlier Engineering Corporation, Detroit, Mich. This new lightweight plier has a quick, positive locking action and is claimed to be extremely durable and easy to use. It is made of alloy steel forgings and stainless-steel rivets to assure long life. The over-all length is 6 inches; throat depth, 1 7/8 inches; and jaw width, 1 1/4 inches. The spindle has a 1/4-28 thread. Weight of the plier is 8 ounces.

Circle 573 on Readers' Service Card



Ther-Monic equipment with three-position work station and other features that facilitate oil- and water-quench hardening operations



## Niagara Redesigned Line of Circle, Ring, and Slitting Shears

A modernized line of power-operated combination ring and circle shears, slitting shears, and flangers has been announced by Niagara Machine & Tool Works, Buffalo, N. Y. These machines have been developed to improve speed and accuracy in circular cutting and flanging operations. The line consists of six basic types of machines designed for medium and heavy sheet-metal work. The ring and circle shears are available in three models with capacities from 10-gage to 3/8-inch mild steel, for cutting circles from 6 to 72 inches in diameter, starting on the inside or from the edge of square blanks. The circle shears include six models with capacities of 1/8- through 1/4-inch mild steel, for cutting circles 10 to 58 inches in diameter, starting at the edge of square blanks. Six models

of slitting shears are available with capacities of 1/8- through 1/4-inch mild steel for slitting sheets of any length into widths of from 5/8 to 23 inches.

A combination ring and circle shear and flanger cuts discs 8 to 58 inches in diameter starting at the edge of square blanks (8-gage mild steel and 12-gage stainless). It turns flanges up to 1 1/2 inches high, and forms truly round heads from 18 1/2 to 73 1/2 inches in diameter. With special cutter, discs 19 1/2 to 58 inches in diameter can be cut, starting from the inside or at the edge of square blanks. This equipment can be converted to ring and circle cutter, to circle cutter, or to flanger in minutes.

A combination circle shear and flanger for light work cuts discs from 5 to 48 inches in diameter,

from square blanks of 18-gage mild steel. It turns flanges up to 1 inch high and forms heads 10 to 48 inches in diameter with inside flanges. For heavy work, it cuts 17- to 80-inch-diameter discs from square blanks of 1/4-inch mild steel and turns flanges up to 2 1/4 inches high. Through the use of a pin pivot, larger diameters (up to 120 inches) can be cut from square blanks.

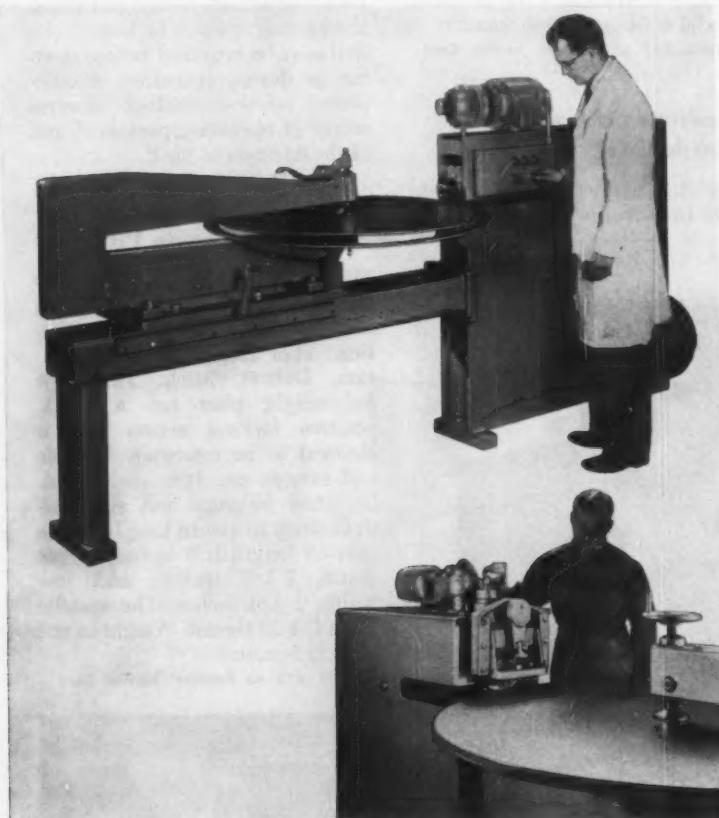
A flanger for extra-heavy work produces flanged heads 26 to 105 inches in diameter (inside flanges) from 3/8-inch mild-steel plate. Heads up to 226 inches in diameter can be produced through the use of a pin pivot. The maximum flange height is 3 inches.

Cutters on all shears are precision-ground, special-grade, heat-treated alloy tool steel. Flanging rolls are case-hardened, high-grade steel. Standard rolls form a 1/2-inch radius at the root of the flange. Rolls for other radii can be furnished to special order. Accessories such as pin pivots, air-operated clamping devices, and special circle arms further increase the range and utility of this line of Niagara equipment.

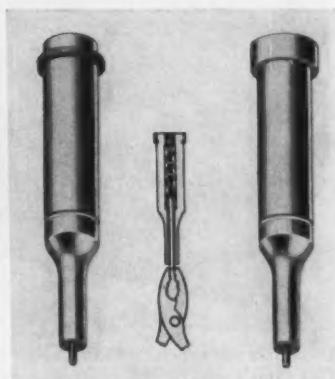
Circle 569 on Readers' Service Card

## Pull-Pin Ejector Punches

Pull-pin ejector feature of a line of punches manufactured by Ring Punch & Die Division, Producto Machine Co., Jamestown, N. Y., greatly simplifies the grinding of these die components. The costly and time-consuming job of disassembly of punches or removal of stripper plates is eliminated. The ejector pin is quickly removed, the punch is sharpened, and the



Redesigned circle, ring, and slitting shears announced by the Niagara Machine & Tool Works



pin is pushed back in. The distance the pin extends is set automatically. The punches, of M2 high-speed steel, are available in

all point shapes, head or ring types, with diameters of 3/16 to 1 inch.

Circle 570 on Readers' Service Card

### Hardinge Improved High-Speed Precision Lathe

An improved model high-speed precision lathe, known as the HLV-H, which combines all the features of the HLV series plus many new ones has been announced by Hardinge Brothers, Inc., Elmira, N. Y. This lathe is designed to fill the gap between the plain precision bench lathe and the heavy-duty engine lathe. It has an 11-inch swing over the bed and infinitely variable speeds of 125 to 3000 rpm obtained by means of a push-button-controlled, electrically actuated drive.

A larger headstock frame and large superprecision preloaded ball bearings are designed to provide maximum precision for sustained operation at full speed. The headstock spindle has a through-collet capacity of 1 1/16 inches and step-chuck capacity of 6 inches. An electrically interlocked stop-pin prevents the main drive motor from being started when the pin is engaged. The headstock drive belt can be changed with-

out removing or disturbing the high-precision bearing or spindle.

Bedways of hardened and precision-ground steel are of dovetail design. The carriage and apron are of one-piece construction and are built for sustained accuracy and rigidity. The carriage has a full bearing on the top of the flat bed for maximum support of cross-slide and carriage ways. All slides have single and adjusting taper gibbs for fine adjustment for precision operation. The base is of modern welded-steel design, completely enclosing the motor, drive, and tool storage compartment.

A built-in automatic thread-length control and quick-acting compound slide for threading are standard equipment. The lead-screw is used for threading only, a separate electric motor being provided for the carriage and the cross-slide feeds. The feed rates are easily changed by simply turning a knob on the control box at the right-hand end of the bed.

By the use of a separate gear-box and lead-screw for threading only, maximum accuracy is sustained for precision threading operations. The power feed is entirely separate and used for feeding only.

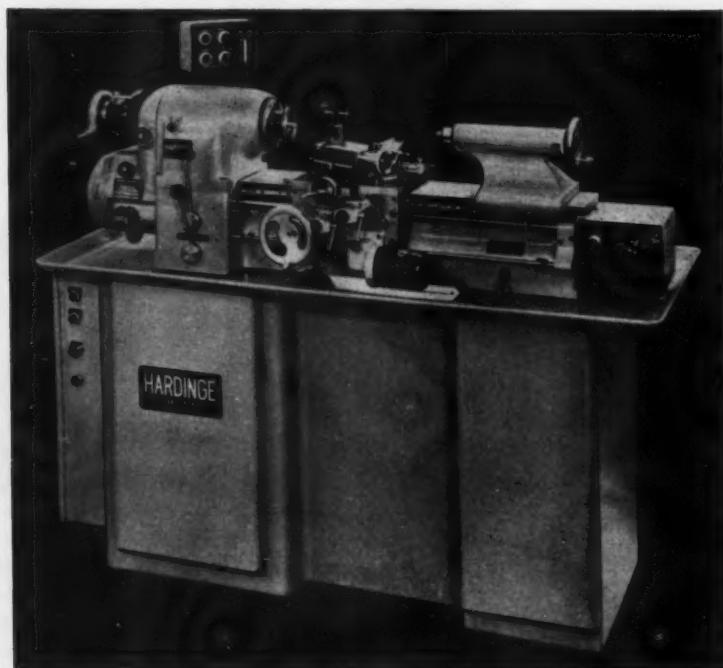
In addition to the new toolroom lathe, Hardinge has also brought out a new model TFB high-speed precision turning, facing, and boring lathe. This machine is the same as the toolroom lathe except that it does not have the gear-box, lead-screw, and other items related to threading. Thus it provides production departments, toolrooms, laboratories, and development departments with the fine features of the HLV-H for work that does not require threading.

Circle 571 on Readers' Service Card

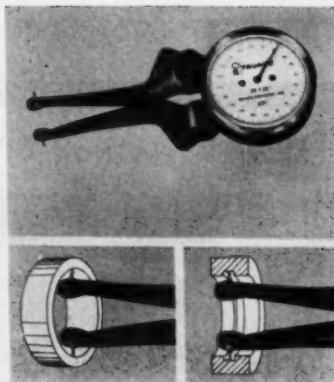
### Direct-Reading Dial Gages

A line of direct-reading, caliper type, dial-indicator groove and bore gages has been introduced by the Truarc Retaining Rings Division of Waldes Kohinoor, Inc., Long Island City, N. Y. The instruments are available in four sizes to accommodate diameters ranging from 0.40 to 3.0 inches. They are calibrated in graduations of 0.001 or 0.0025 inch, depending upon size, and have a reach of 2 3/8 inches. Rigid cast arms assure accuracy of measurement and eliminate any possibility of deflection. The gages have a shock-proof, jeweled movement and unbreakable crystal. Contact points are adjustable and can be replaced with points having special configurations for unusual job requirements whenever necessary.

Circle 572 on Readers' Service Card



Improved high-speed precision lathe announced by Hardinge Brothers, Inc.



# 3

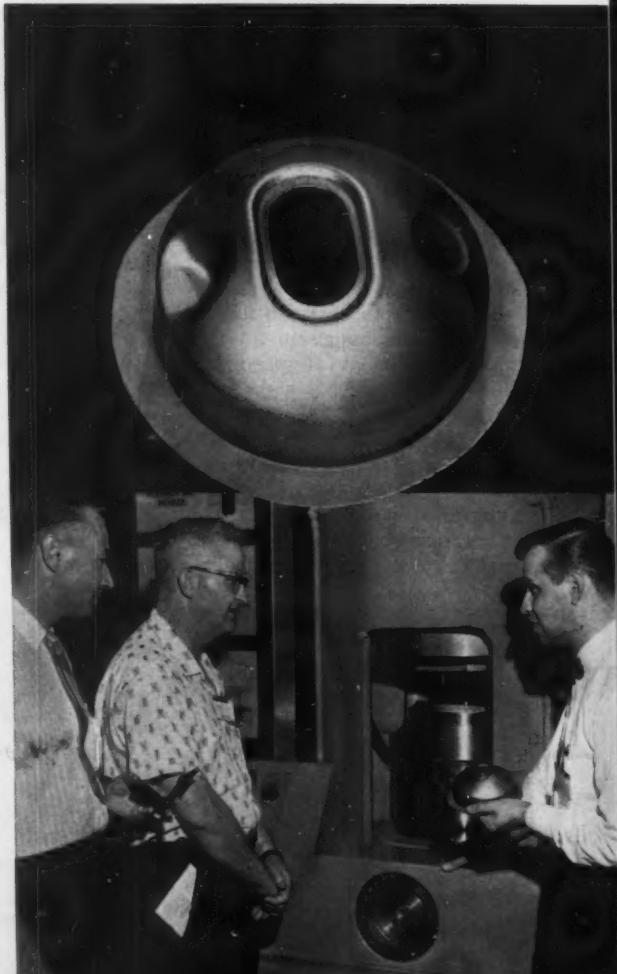
# CINCINNATI®

move metals into the shapes

## Moving Metal

... by HYDROSPIN roll flowing... by the INTRAFORM process of continuously squeezing metals between revolving dies and a forming mandrel... by the HYDROFORM process of simplified deep drawing... these are CINCINNATI's highly advanced chipless machining methods using low-cost tooling, that have established new standards for component parts production in plants of all kinds.

To learn of the latest developments in the field of chipless machining, and how you can apply its cost-reducing and quality-improving advantages to your metalworking, call in a Meta-Dynamics Division field engineer.



### META-DYNAMICS DIVISION



THE CINCINNATI MILLING MACHINE CO.

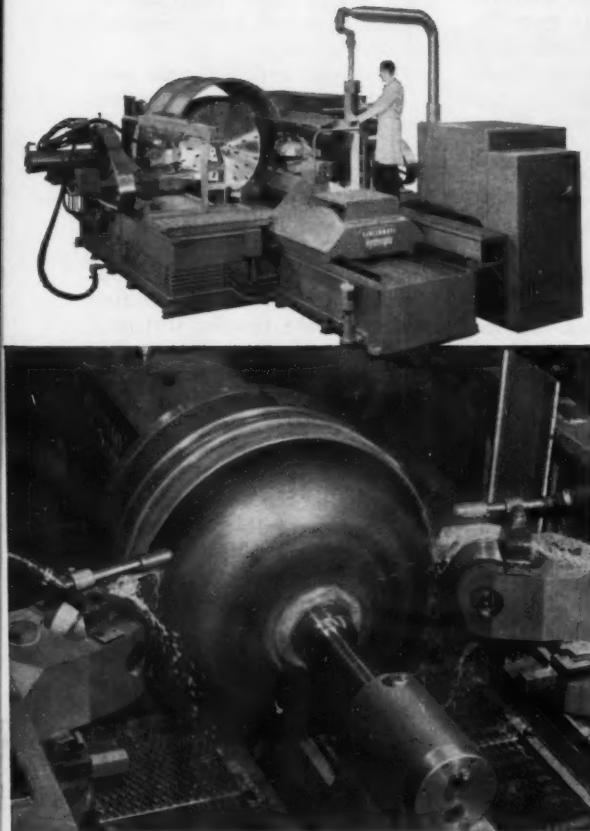
Cincinnati 9, Ohio

### CINCINNATI HI-SPEED HYDROFORM

produces the housing shown to precision dimensions in a single 5-second draw cycle from an 8" dia. blank of .047" mild steel. Hydroform tooling normally costs 1/10 of conventional draw dies. The process produces parts of more intricate shape, having improved mechanical and physical properties, in far fewer operations than is possible in common practice. Hydroform machines are built in sizes for drawing blanks up to 8", 12", 19", 23", 26" and 32" dia.

# chipless machining methods

you require at lower costs per part



## CINCINNATI HYDROSPIN

roll-flows metals into a wide variety of shapes having circular cross section. The metal undergoes severe shear deformation which results in a part possessing increased strength, hardness and resistance to fatigue. An example of Hydrospin savings: one user recently paid for his Hydrospin machine with the first 100 parts spun! Hydrospin machines are built in horizontal and vertical styles in various sizes and forces, including those capable of swinging 80" blanks of 1½" thick stainless steel.



## CINCINNATI INTRAFORM

has reduced the dollar-eating hours of machining complex internal profiles, to a few cents worth of seconds! The automobile starter clutch housing shown above was Intraformed from a simple screw machined blank to produce the spline, bearing surface and cam profile, at the rate of 260 parts per hour, and at a tool cost of less than 1¢ per piece. Former tooling cost for the part was 45¢ each. Cincinnati Intraform machines are also cold working seamless and welded tubing to new highs in precision dimensional tolerances and finishes —are equally adept at reducing, sinking and the laminating of tubing.

## Dual-Amp Precisionaire Gage for Checking Internal Grinding Work

A Dual-Amp Precisionaire gage has been developed by the Sheffield Corporation, Dayton, Ohio, to facilitate the rapid grinding of close-tolerance work up to 12 inches in inside diameter. This gage combines low amplification, long gaging range, and high amplification close-tolerance inspection in automatic sequence. Any time a measurement is made, the right-hand column shows the part size within the eighteen-thousandths range and the left-hand column spreads the final two thousandths over 4 inches on the scale.

For example, a part is to be ground to a specified size within 0.002 inch. Grinding progress in

approaching the specified size is indicated by the descending float in the right-hand air tube each time the adjustable 3- to 12-inch-diameter Airebore gage is inserted into the part. As the float nears the 2 in this tube, the float in the other tube descends into view and the size within the final two-thousandths inch is read on that tube with unequalled speed and accuracy because it is spread over four full inches on the scale. Existing 3- to 12-inch Airebore gages can be modified for use with the Dual-Amp Precisionaire gage by returning the kit to Sheffield or by purchasing an interchangeable Plunjet gaging cartridge.

Circle 575 on Readers' Service Card

## Thread-Rolling Machine with Variable-Speed Drive

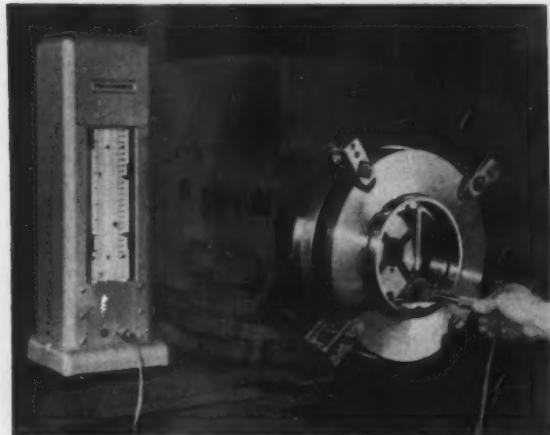
A low-cost Lan-Nu-Rol cylindrical-die thread-rolling machine designed for high production has been developed by the Landis Machine Co., Waynesboro, Pa. This machine can be adapted to either automatic through-feed rolling or to hand-loaded infeed rolling. It utilizes the two-roll principle in order to obtain the maximum spindle and bearing capacity. The two-roll design is also said to minimize die cost, setup time, and the need for auxiliary equipment.

Spindle speeds are infinitely

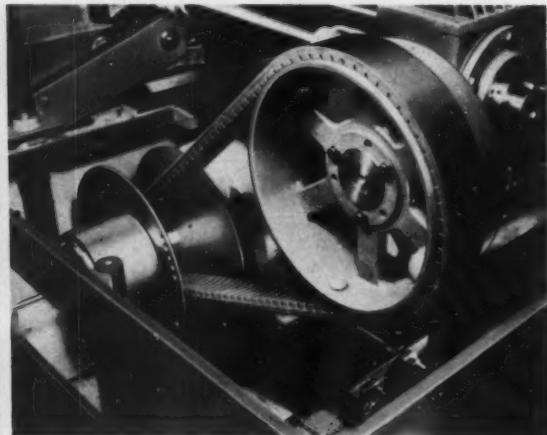
variable from 166 to 500 rpm. The wide range of adjustment provides the correct die speeds for all pitches and diameters within the range of the machine. The simple, efficient drive transmission employs no change-gears. Power from the 7 1/2-hp motor, operating at 1750 rpm, is transmitted to the gear-box by a variable-speed belt drive. To change speed, it is only necessary to turn a crank and read the revolutions-per-minute output on a reference plate attached to the bed. The design of the thread roller is such that limited access is available to the variable-speed drive. Maintenance requirements, therefore, had

to be reduced to a minimum. It is also necessary to change speeds frequently in switching from one production job to another. Freezing or sticking of the variable-speed drive cannot be tolerated. These requirements have been met by the MS-127-10 variable-speed pulley manufactured by T. B. Wood's Sons Co., Chambersburg, Pa. This pulley is adjustable in pitch diameter from 4 1/4 to 12 3/4 inches. The driven or companion pulley is a flat-face type 12 inches in diameter by 5 inches in face width. A W72 belt (2 3/4 inches wide, 21/32 inch deep, and 72 inches long) and an adjustable motor base complete the simple setup.

The Wood variable-speed pulley incorporates a new design that eliminates fretting corrosion, as well as freezing and sticking. Bearing surfaces are reoiled from an oil reservoir with each rotation of the pulley. The continuous rotational pumping action of the flange hub on the sleeve constantly renews and evenly distributes the oil film on the bearing surfaces. There are no keys to obstruct the flow of oil around the surfaces between the flange hub and sleeve. Fabric-faced rubber keys, located outside the bearing surfaces, transmit the power from the stationary to the moving flange through a removable sleeve cap. The torsionally resilient keys not only carry the belt torque but assure equal transmission of power by both flanges.



Sheffield Dual-Amp Precisionaire gage employed in checking close-tolerance internal-grinding job



Wood's MS-127-10 variable-speed pulley drive installed on Landis Lan-Nu-Rol thread-rolling machine

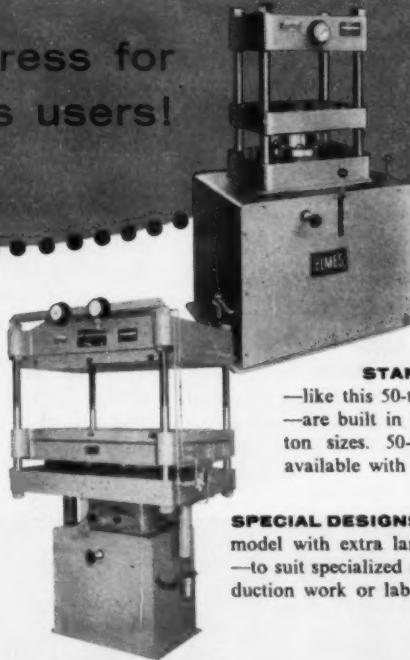
# ELMES HYDROLAIR...

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Under conditions of normal operation, the oil reservoir requires checking only twice a year. O-ring seals retain the lubricant for long periods between refills. Pulleys will run indefinitely at set speed without sticking. There is no down time and no periodic running through the speed range. To obtain maximum speed of the driven machine, the handwheel on the adjustable motor base is turned to move the motor towards the driven machine. The belt will then run at maximum pitch diameter, around the maximum circumference of the variable-speed pulley.

Turning of the motor-base handwheel in the opposite direction, to move the motor away from the driven machine, will slow the speed through a continuous range. In the minimum-speed position, the belt runs at minimum pitch diameter, around the minimum circumference of the variable-speed pulley.

Circle 574 on Readers' Service Card

### Combination Sheet and Billet Lifter

The Hill Acme Co., Cleveland, Ohio, has brought out a combination sheet and billet lifter designed to handle single sheets, slabs, billets, or ingots. Multiple-vacuum

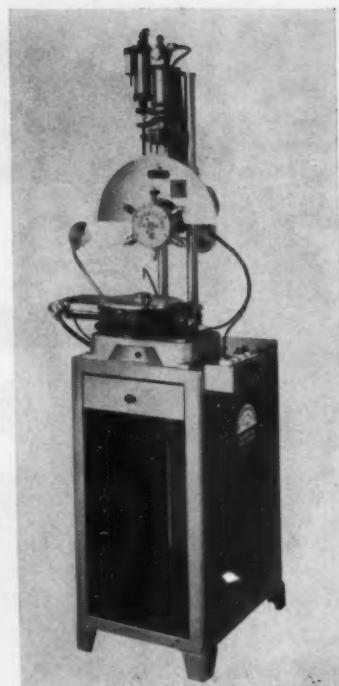
cups or scissors tongs are used as required for a given work-handling job. The tong action is automatic, and the face of the material being handled is protected by supporting rollers attached to the tong arms.

The frame supporting the vacuum cups is actuated by air cylinders controlled by a solenoid valve. The lifter incorporates its own vacuum system, including motor, pump, and vacuum reservoir. These unique lifters are ideally suited for handling non-ferrous materials, as well as ferrous metals, and are made in sizes and capacities to fit customer requirements. The unit illustrated has a tong capacity of 8000 pounds and a vacuum-lift capacity of 1200 pounds, both with adequate safety factors.

Circle 576 on Readers' Service Card

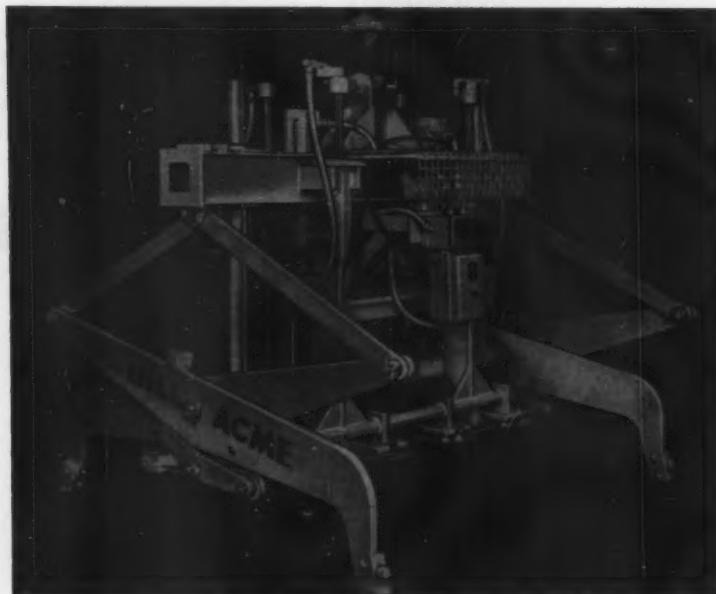
### Burgmaster Automatic Turret Drill

Automatic bench-model, six-spindle turret drill built by the Burgmaster Corporation, Gardena, Calif., which provides automatic power feed and turret indexing. This machine, rather than the operator, sets the machining pace and is said to increase production on work requiring precision drill-

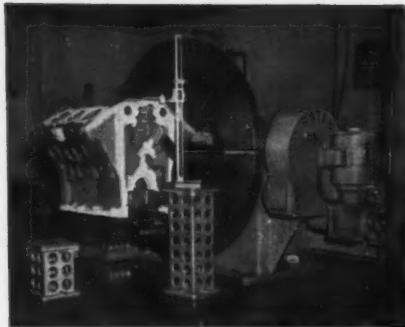


ing, reaming, tapping, etc. Controlled, infinitely variable power feeding with preselective individual spindle speeds that automatically shift insures optimum machining efficiency, fine finish, and long tool life. Individual depth stops are provided for each spindle to permit rapid traverse to the work and limit depth of cut. Three modes of operation give full flexibility: manual-single-spindle operation with power feed and turret indexing only at push-button signal; semiautomatic-turret cycles through predetermined sequence of operations including skip index of idle stations, stopping for manual load and unload; and full-automatic-machine's controls are interlocked to synchronize with shuttle tables, index features, hopper feeds, air blasts, coolant, etc.

Circle 577 on Readers' Service Card

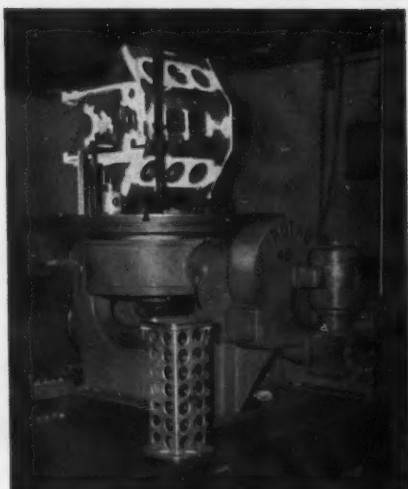


Combination sheet and billet lifter brought out by Hill Acme Co.



## Dimensional check on 7 planes in one set-up!

up to 50% savings  
in time and  
manpower



Yes . . . every angle, diameter, straight line, every critical surface, on seven different planes of a V-type block, completely accurately checked without disturbing the initial set-up! How is it possible? With Machine Products' ROTAB universal rotary positioning table, that's how.

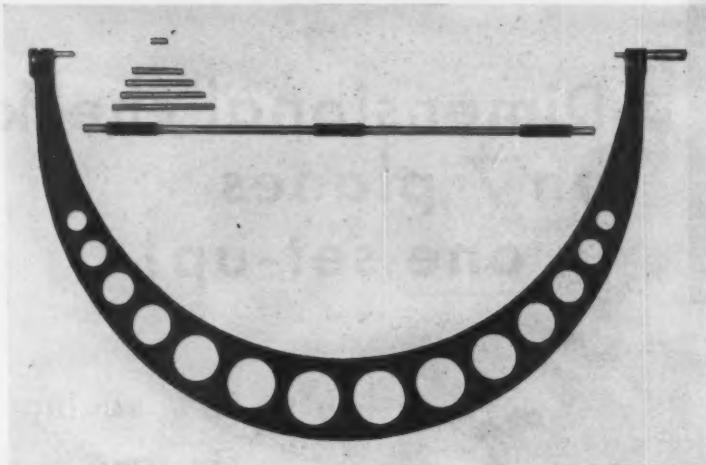
And consider the advantages. Previously, this same operation required two men, who had to "wrestle" the block into seven separate set-ups . . . each time re-establishing the locating point. With ROTAB the V-block is loaded on the horizontally positioned table, locating point determined, block clamped in place. Then, ROTAB's precision, movable graduated ring is set at zero to start the angular or radial check, and one man, using motor-powered, push button tilting and rotation runs the entire inspection, saving up to 50% in time, increasing accuracy, reducing rejects.

This, briefly, is what ROTAB has accomplished for one of the nation's leading diesel engine manufacturers.

ROTAB, with its unlimited applications, can do wonders for you, too.

Write today for your catalog!

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Micrometer available in two size ranges from the J. T. Slocomb Co.

sizes with measuring capacities from 15 to 18 inches through 33 to 36 inches. The 8-inch range is furnished with six interchangeable anvils and can measure 12 to 18 inches through 30 to 36 inches. These two sizes are offered with malleable iron frames having holes in the web to reduce the weight.

The larger-range micrometer sizes 36 to 42 inches through 54 to 60 inches (larger on special order) feature Slocomb's "rigitube" construction designed for lighter weight and dependable accuracy.

Like all preceding Slocomb micrometers, the new models are constructed with a unique adjusting-nut assembly that provides full engagement with the spindle thread. This feature tends to make the sensitive instrument shock-proof.

Circle 578 on Readers' Service Card

#### Oscillating Abrasive Saw

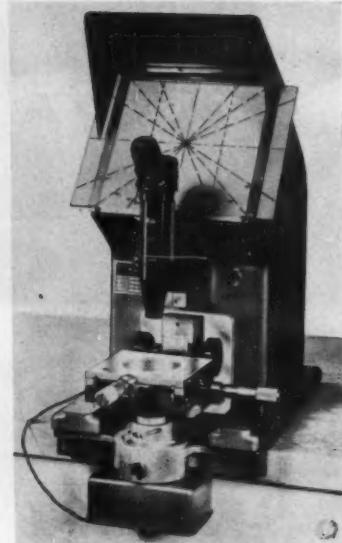
Series 1520 A-60 Oscila-Modular wet- and dry-cutting units is announced by the Wallace Supplies Mfg. Co., Chicago, Ill. These machines remove metal at a rate of four to ten seconds per square inch. The wheel-head automatically oscillates as it rotates, under the control of Bellows air cylinders equipped with hydraulic checks. Oscillation is infinitely variable up to 100 strokes per minute, and stroke length can be set from 5/8 to 6 inches.

For wet operation, an external system pumps up to 45 gpm of coolant. The series comprises four sizes, with wheels of 16, 18, 20, and 26 inches, respectively.

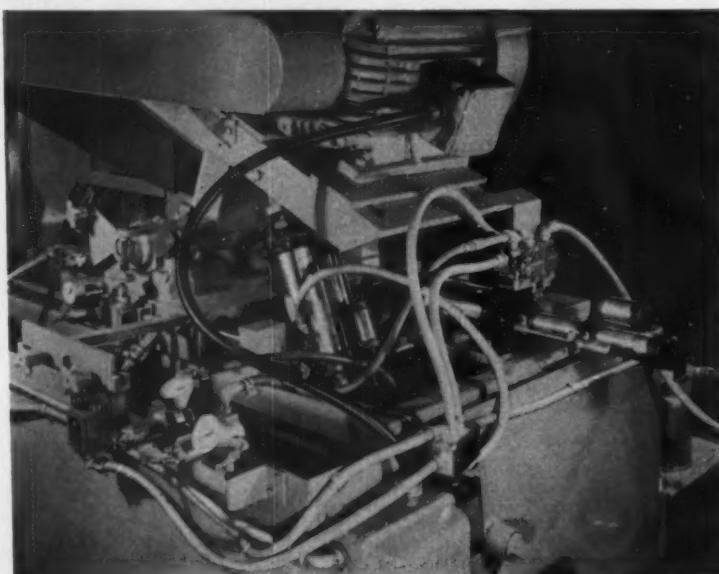
Circle 579 on Readers' Service Card

#### Wilder Duplex Optical Comparator

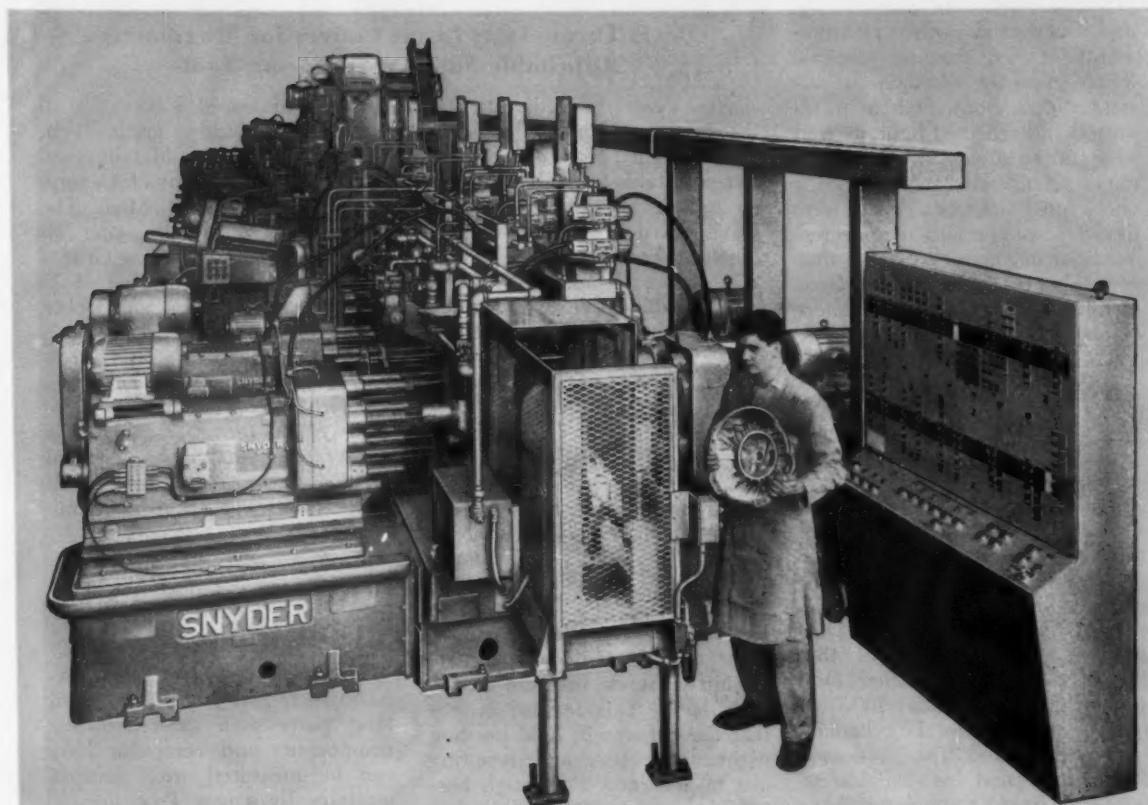
R. S. Wilder, Waltham, Mass., whose instruments are marketed exclusively by Opto-Metric Tools, Inc., New York City, announces a new model small-parts comparator. It combines two instruments



in one: an optical bench comparator and a toolmaker microscope. Basically it follows the same principle of design as in previous models of Wilder Micro-Projectors—of unit construction insofar as lenses, measuring tables, illuminators, etc., are interchangeable or can be added as needed. In this model, an additional and unique feature is available by converting the instrument into a toolmaker microscope. This is done by replacing the projection lens by a Leitz toolmaker-microscope tube as shown. This is particularly valuable in high magnifications.



Oscila-Modular cutting unit announced by Wallace Supplies Mfg. Co.



## DIFFERENT SIZED PARTS INTERMIXED AT RANDOM ARE PROCESSED AUTOMATICALLY ON SNYDER SPECIAL 56-STATION TRANSFER

Here's another big Snyder special "building-block" transfer with a bit of extra versatility. Specifications called for one sequence of operations on a big aluminum transmission cover case for domestic use and a different sequence on a smaller cover for export.

Schedules set a production rate of about four domestic units to one export unit but, for production convenience, the machine had to accept these parts intermixed at random and run them through automatically.

So, Snyder Engineering designed a "collar" which bolts to the smaller piece, bringing it up to locating and clamping dimensions of the larger piece. Lugs on the collar and workpiece control appropriate switches which by-pass certain operations. Parts are automatically positioned in process.

Operations include drilling, reaming, boring, tapping, chamfering, spotfacing, center holing, end

milling, probing, air gaging, pressing in rectangular plug, pressing in bushing and a couple of washing operations.

Production is 150 parts an hour at 100% efficiency. Any of the 20 segments can easily be converted for comparable operations on other parts and the number of segments can be increased or reduced at any time. Your inquiries are invited.

# SNYDER CORPORATION

*(Formerly Snyder Tool & Engineering Company)*

3400 E. LAFAYETTE—DETROIT 7, MICHIGAN

Phone: LO 7-0123

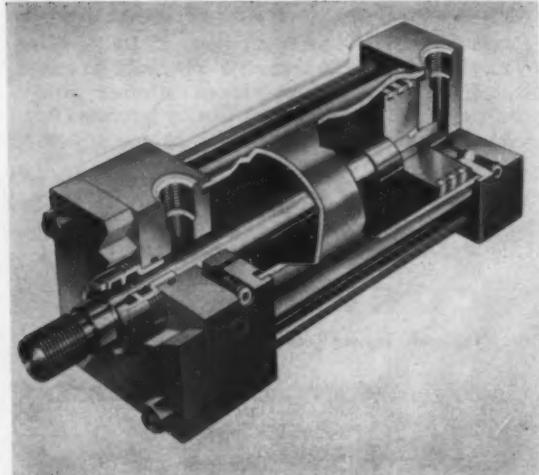
and illuminated surface measurements. Other features include ample working distance for assembly operations, both in transmitted and reflected light, as well as a sliding screen for zeroing to micrometer settings or quick check points. Optically the new model uses specially engineered lenses of maximum precision that are said to be practically free from distortion and which can be interchanged to suit the work.

Circle 580 on Readers' Service Card

### Hannafin Thousand Pound Hydraulic Cylinders

A line of power cylinders for use in medium-high-pressure hydraulic service has been announced by the Power Cylinder Division of the Hannafin Co., Des Plaines, Ill., a division of the Parker-Hannifin Corporation. Designed for use with 1000-psi pumps, these Series L cylinders have been termed "The Thousand Pound Line" and are available in bore sizes from 1 through 8 inches, all designed to operate at 1000-psi hydraulic pressure. They are of square head and tie-rod design, and have case-hardened and chromium-plated piston-rods as standard equipment. Drip-free rods and leakproof ports are also featured, and fourteen different mountings are available.

Circle 581 on Readers' Service Card



Cutaway view of power cylinder announced by Hannafin Co.

### Davis Throw-Away Insert Cutters for Micrometer-Adjustable Super-Mike Boring Tools

New cutters with standard throw-away carbide inserts have been designed for use in micrometer-adjustable Super-Mike fly-cutter tooling manufactured by the Davis Division, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. These fly-cutter assemblies are available in stub boring tool sets, stub and line bars, multiple-cutter boring heads, extension boring heads, and other types of Davis tooling. The new throw-away insert cutters are interchangeable with standard HSS or carbide Super-Mike cutters.

In the micrometer-adjustable Super-Mike assemblies, such as the one illustrated, the cutter is adjustable in increments of 0.0001 inch by means of a direct-reading micrometer dial screw. Adjustment can be made without releasing set-screw pressure on the tool shank. This feature insures that the cutter will hold position without backlash and resulting loss of accuracy. For rough boring, the new cutter can be accurately set with a gage and then dial-adjusted for semifinish and finish boring.

Circle 582 on Readers' Service Card

### Improved Carboloy Grade

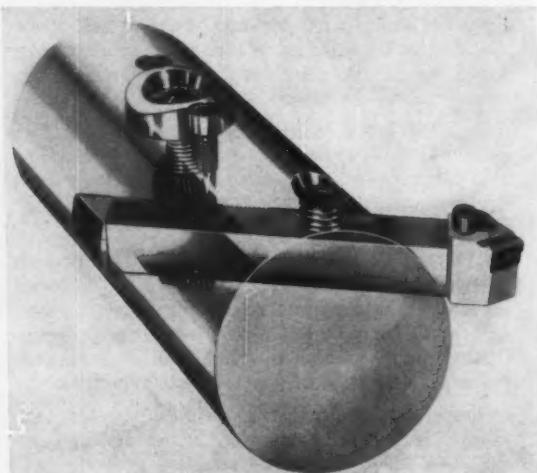
Higher quality and hardness and greater wear resistance character-

ize the improved Carboloy 78B cemented-carbide grade announced by the Metallurgical Products Department of General Electric Co., Detroit, Mich. The department is able to offer all standard tool products in Grades 78 and 78B at a reduction of 25 per cent in unground metal base price. Carboloy 78B is available in a full line of utility and precision prehoned disposable inserts and in brazed tooling. The line also includes most standard blanks in 0000 to 7000 styles. Special shapes and sizes are also available for unusual machining jobs.

Circle 583 on Readers' Service Card

### Precisionaire Gage for Checking Slot Location

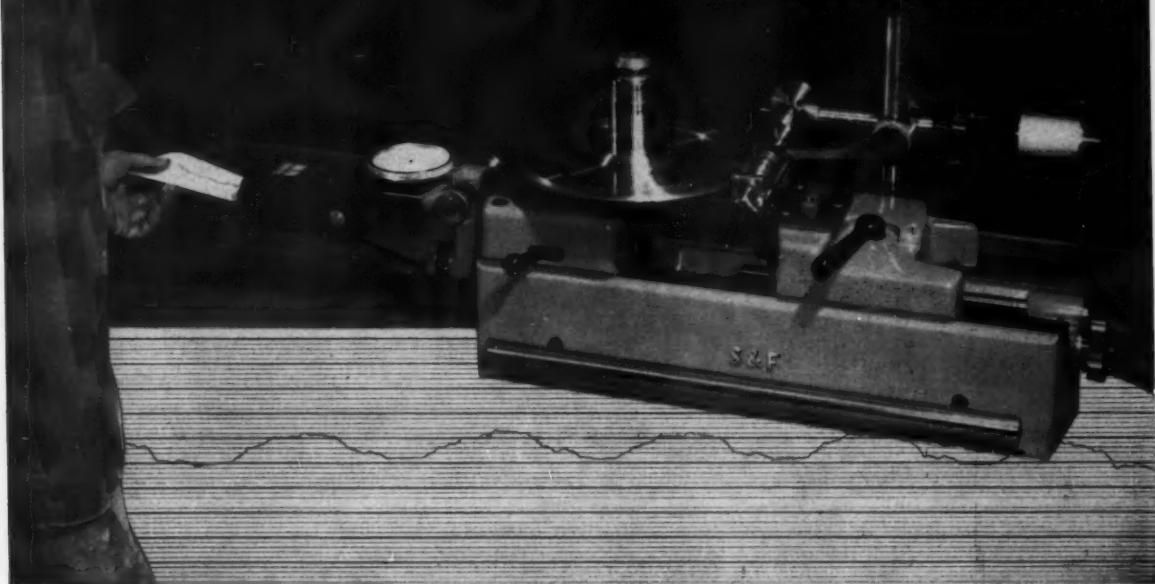
The location of slots as small as 0.050 inch and smaller holes in long parts such as microwave components and computer bars can be measured with unusual accuracy by a new Precisionaire inspection instrument of the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. The instrument inspects hole location and center distance, slot width, and depth of various-shaped cavities in rectangular and round parts. It handles parts of various thicknesses and widths up to 12 inches.



Davis Super-Mike micrometer adjustable fly-cutter bar

"With the S & F gear tester  
**we make sure our gears  
are as accurate as  
specifications demand"**

says Philips Electronics, Inc.



Section of Graphotest record checking out 10" pitch diameter gear on S & F Model 110 Gear Tester at Philips Electronics.

**there's no gear tester as accurate as the S & F—  
GUARANTEED TO REPEAT WITHIN .00001"!**

The engineer sets down his gear specs. The gear hobber goes to work. The gear tester checks out the finished gear. Perfect! *But is it?*

The plain fact is that the gear tester is all too often the weakest link in the chain. And until the S & F came along, manufacturers had no sure way of knowing their "precision" gears were as precise as they were supposed to be.

No such doubt exists at Philips Electronics. Shown above is a special spur gear used on the Norelco Goniometer. Its basic pitch diameter is 10", diametral pitch 36", number of teeth 360. Print specs call for a total

composite error on 360° rotation of .001" and the gear must be concentric within .0003", total indicator reading. Pretty close tolerances for a gear of this size.

Has Philips achieved it? They're never in doubt. "We are now able to verify the accuracy of our gears to an extent never before possible," say Philips engineers.

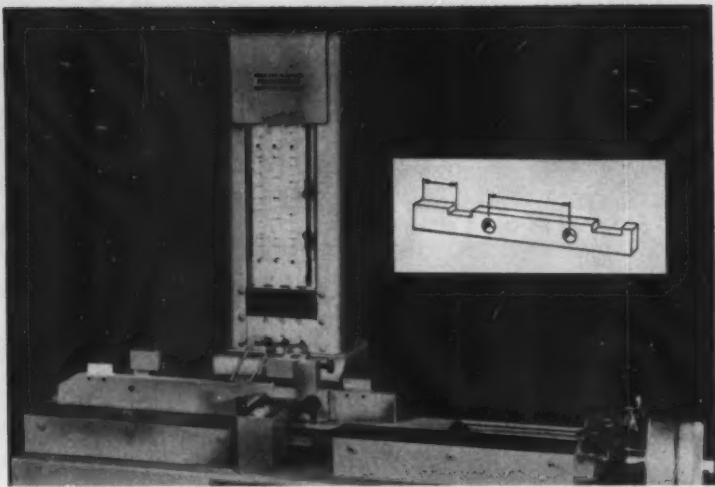
And this experience is typical of hundreds of precision-minded plants all over the country who are producing gears that *must* check out—and do—on S & F Testers.

We'd like nothing better than to show you how the S & F is revolutionizing gear checking. Or talk to any users near you. We'll send you their names.



**KURT ORBAN**  
COMPANY, INC.

42 Exchange Place, Jersey City 2, New Jersey



Sheffield Precisionaire instrument for measuring relative positions of slots and holes

long. Models for measuring parts of other sizes can be supplied.

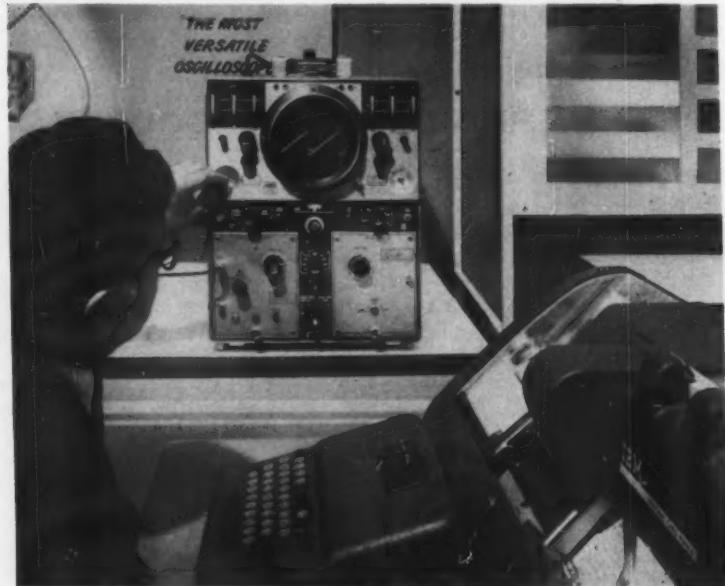
The equipment consists of a precision-built gage table and a three-column Precisionaire instrument. A Sheffield 1-inch range micrometer is located at one end of the gage table. This ultra-

precise micrometer is guaranteed accurate to plus or minus 0.000010 inch per inch. It is used in conjunction with end standards to set the part print dimension in the gage against which the actual location of the holes and slots in the part are checked.

#### Du Mont Oscilloscope Prints Results on IBM Machine

The indeterminate electronic patterns of wave forms on an oscilloscope have been tied down to direct numerical (digital) readings

by the Allen B. Du Mont Laboratories, Inc., Clifton, N. J. Of equal importance, these numerical readings are automatically transferred



Du Mont 425 oscilloscope and modified IBM 026 printing key punch arranged to record and analyze oscilloscope data

In operation the part is clamped to the movable gage-plate. Any deviation in hole or slot location from the prescribed dimension, as the table is moved in relation to the fixed stop, is indicated and read in the appropriate column in the Precisionaire instrument. Longitudinal movement of the ball-slide gage table in reference to a fixed stop is controlled by a lead-screw with handwheel. This device is equipped with pawl and ratchet that prevent the table from being brought against the fixed stop with excessive pressure.

Slot depth is checked with a contact type gage stylus having a micrometer adjustment to govern the depth at which the check is made. This dimension, too, is indicated and read by the position of the float in one of the air columns. Interchangeable gage heads with leaf type contacts that actuate Plunjet gaging cartridges are used to pick up hole or slot locations and to measure depths.

Circle 584 on Readers' Service Card

to key-punch machines for permanent record and statistical analysis. The Du Mont 425, said to be the first direct numerical reading oscilloscope, is shown in the accompanying illustration tied into a modified IBM 026 printing key punch. This direct tie-in of an oscilloscope with key-punch equipment brings automatic tabulation of statistical test data directly to the factory or laboratory floor, translating test results directly onto key-punch cards. The 425 oscilloscope can also feed its data directly to both analog and digital computers.

Where a variety of tests are made, information from a number of oscilloscopes can be printed on a single card with consequent cost savings. This automation of complex electronic testing, quality control, and production control enables less-skilled operators to get precise test results time after time. It also permanently records the data for every type of statistical analysis likely to be encountered in industry.

Circle 585 on Readers' Service Card

# JONES & LAMSON MACHINE COMPANY

the man who needs

a new machine tool is  
already paying for it



## If you don't buy now... You'll pay later

You can bank on it. If you don't buy new production equipment now, you *surely* will pay later, and the price will be high in more ways than one.

The recent Machine Tool Exposition in Chicago demonstrated beyond a doubt that production economics and production techniques are undergoing rapid and sweeping changes.

As a result, production management is faced by two big jobs, 1.) Deciding *which* items of new, advanced equipment are best suited to individual plant requirements, and 2.) convincing top management that this new equipment *must* be acquired, and that it can be paid

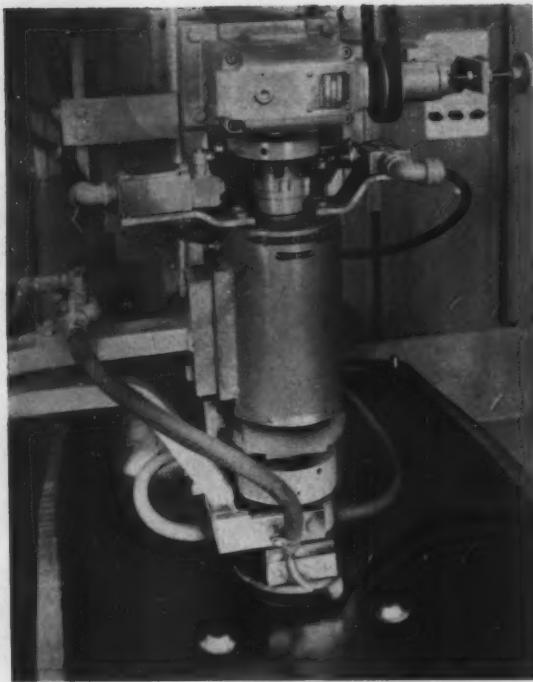
for easily in a way best suited to your needs.

Jones & Lamson can help you with this twofold problem. First, the new J&L line of machines is broad in application over a great variety of operations. Second, these machines will pay for themselves out of Profitivity®, and can be leased at an hourly rate of \$2.50 per \$20,000 of machine value: There's no advance payment, and the hourly rate drops to 12½¢ after five years.

Literature telling about the machines, how to justify their purchase, and how to pay for them, is yours for the asking.

Write to Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



Precision Welder and Flexopress Corporation's newly developed Wobble-Head seam welder



Rofran portable Pee-Wee abrasive belt grinder for finishing metals and plastics

### Seam Welder for Making Strong Circle Welds

The Precision Welder & Flexopress Corporation, Cincinnati, Ohio, has developed a Wobble-Head welder designed to bridge the gap between circular seam wheel welders and ring projection welders. Seam welders with wheel electrodes become impractical for welding circles much smaller than 6 inches in diameter, and fixed electrode ring projection welders experience difficulty welding circles bigger than approximately 2 1/2 inches in diameter. The new precision Wobble-Head is said to be ideally suited for handling ring-welding jobs from 3/4 to 6 inches in diameter.

In the Wobble-Head welder the electrode is a circular cup type die running on an adjustable eccentric drive. The cup die works on edge, touching the work-piece with rolling—not sliding—point contact. An electrode cup die is chosen which is slightly larger in diameter than the weld to be made, and the specified ring diameter of weld is attained by adjusting the tilt of the cup die.

Typical uses for the Wobble-

Head welder include welding filler necks and large drains to tanks, welding heat-exchange tubes to header plates, and welding flanges to large-diameter, thin-walled tubing.

*Circle 586 on Readers' Service Card*

### Versatile Low-Cost Belt Grinder

A low-cost, portable abrasive belt machine for light grinding and finishing of wood, plastic, and metal has been developed by the Rofran Co. of Linden, N. J. Called the Pee-Wee because of its small size, the sander deburrs, removes seams, and polishes small parts fast and economically. Designed for light industry and home use, it affords clean cuts on many types of surfaces, curves, scrolls, and inside edges with minimum equipment, time, and effort.

The grinder has a frame made of heavy cast iron, webbed at the stress points. Its pulleys operate on double-shielded ball bearings rated at 2500-hour continuous service. For added rigidity, its lower drive pulleys run on two such bearings. The machine is de-

signed to grind both inside and outside surfaces, performing either operation by a simple rearrangement of the pulleys and coated abrasive belt. It uses an abrasive belt 1 by 42 inches for polishing inside contours and 1 by 48 inches for conventional work. Always under spring tension, the abrasive belt runs cool and smoothly at its operating speed of 2100 sfm. A precision adjustment on the top idler pulley provides perfect belt tracking. The belt is easily changed.

A metal platen, 1 inch wide by 2 3/4 inches high, backs up the abrasive belt. Held securely by two screws, this flat backstop can be removed quickly for free belt grinding or replaced easily with a shaped platen for angular polishing. A calibrated protector on the side of the sander simplifies setups for grinding beveled, curved, or straight edges. The machine uses a 6- by 6-inch cast-iron table to support the work-piece. This table can be tilted forward 70 degrees and locked in position at any angle for accurate beveling. The machine measures 8 by 16 by 22 inches.

*Circle 587 on Readers' Service Card*

**JONES & LAMSON**

**"AUTOMATION"**

the man who needs

a new machine tool is

already paying for it



### **Completely automatic turret lathe gives peak production efficiency**

J & L's new, completely automatic turret lathe sets a new high standard of efficiency for both bar and chuck work. Now, for the first time, you have the versatility of turret lathe tooling combined with completely automatic operation. All machine functions and sequences are pre-selected and programmed by the operator or set-up man, from a staging panel during initial set-up.

The automatic machine characteristics of this new lathe include fast motion, variable speed selection, spindle speed selection, turret indexing, coolant on and off, bar feed, and cycle stop.

A noteworthy feature is the automatic operation of a 12-speed hydraulic clutch

headstock combined with a 24" saddle motion which is actuated by a closed-loop, two-stage hydraulic servo system.

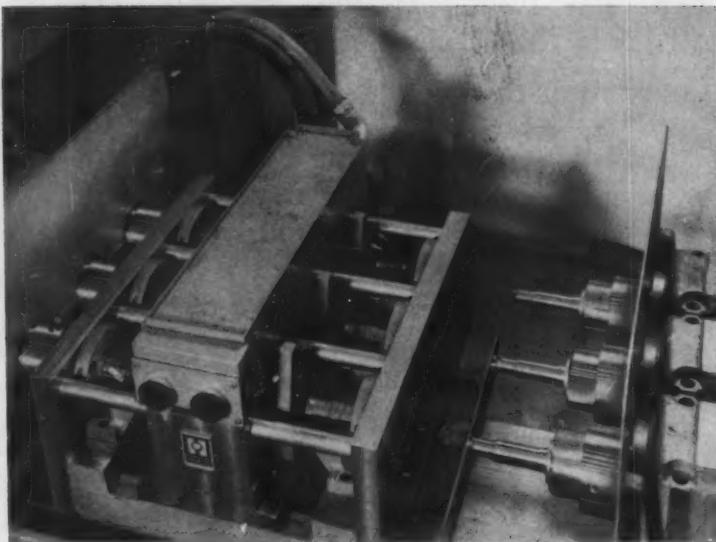
The cross slide has a 14½" stroke and drive similar to that of the saddle, and has several automatic cycles, as programmed from the staging panel. Three speed ranges are available: 20 to 1000; 30 to 1500; and 40 to 2000 RPM. Power is from a single speed motor (up to 40 HP). Feed range is from .750" per minute to 30" per minute for the saddle, and from .375" per minute to 15" per minute for the cross slide.

Send now for our folder on this remarkable new machine. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines

• Thread & Form Grinders • Optical Comparators • Thread Tools

## Bore-Matic Equipped to Precision-Bore Brake Cylinders



Heald Bore-Matic equipped to process brake cylinders

A six-station Bore-Matic built by the Heald Machine Co., Worcester, Mass., precision-bores 405 gray-iron rear-wheel brake cylinders per hour at Chrysler's Highland Park plant. This production rate is obtained when operating at 75-per-cent efficiency. A hydraulically operated clamping fixture holds six parts, three on each side of the machine. Each station is interlocked so that the table cannot move inward unless all parts are clamped.

Although this is an "end stop" cycle, two "memory" push buttons—one for each side—make the cycle continuous. While the parts on one side are being bored, the operator unloads and loads the other and pushes the memory button. When boring is completed, the head stop and the tools retract while tools on the opposite side are reset.

The table automatically reverses and the timer unclamps the finished parts when the tools are clear. The opposite side is then clamped while the table hesitates at center stop and the table advances and slows down to finish-bore. Stock removal is 0.038 inch and the tolerance is plus or minus 0.0005 inch. The back-to-back hydraulic clamping fixture has stellite-faced wear surfaces.

Circle 588 on Readers' Service Card

precision table of this machine has a positioning range of 30 by 20 inches with an accuracy of plus or minus 0.00025 inch. Preselected speeds, feeds, and tapping cycle are available for any or all of the six spindles, and positive stops with dwells for accurate facing and counterboring are outstanding features.

Spindles are heavy-duty alloy steel mounted with taper roller bearings. They are available with straight bore for No. 3 Morse taper ASA adjustable adapter assembly, or flanged nose for stub-nose collet chucking tools for light milling operations.

The turret column ways and the positioning-table ways are hardened and ground. The lower column base is massive in construction, and the base and table have ample coolant capacity.

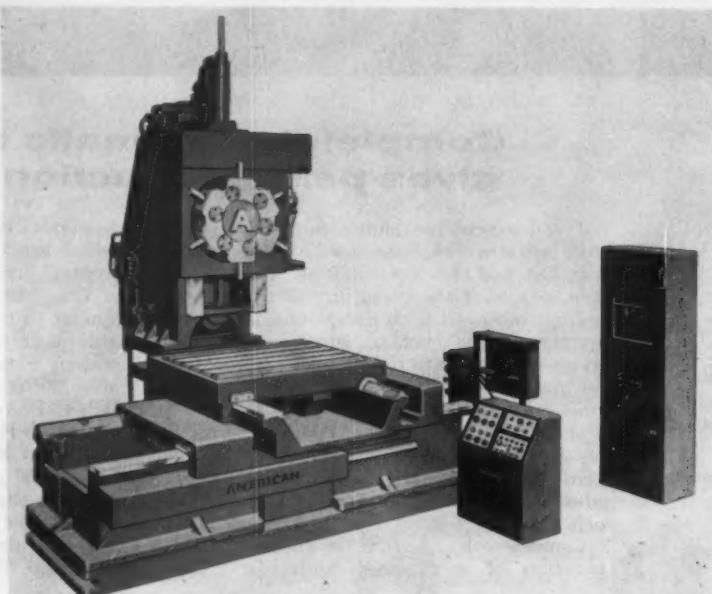
Circle 589 on Readers' Service Card

## Numerically Controlled Six-Spindle Turretex with Precision Table

A six-spindle Model AA Turretex which drills, taps, reams, counterbores, and faces automatically has been announced by the American Tool Works Co., Cincinnati, Ohio. The two-axis, ultra-

## Die-Set Ball Bushings

Ball bushings designed specifically for use on die sets are announced by Thomson Industries, Inc., Manhasset, N. Y. They are interchangeable with standard plain bronze or steel bushings in existing dies. The bore diameter is dimensioned to fit standard guide pins in use today. The ball



American Tool Works six-spindle Turretex with numerical control

# JONES & LAMSON MACHINE TOOLS

the man who needs

a new machine tool is  
already paying for it



## New improved design for J & L Ram and Saddle Type Turret Lathes

These two new J & L lathes are *really* new. No mere face lifting here . . . both lathes have been completely redesigned from the floor up!

Both the Ram type and Saddle type lathes are equipped with a multi-speed hydraulic headstock, and are capable of giving you more chips per tool, more pieces per hour, and more profit per job.

The redesign of these machines starts with 41" of leg depth for more stable footing. New cross-ribbed bed design provides even greater rigidity for heavy cuts — and gives straight-line chip disposal out the back. The new wide pan includes a built-in accessible coolant tank at the head end of the machine. The new headstock transmits up to 40 HP.

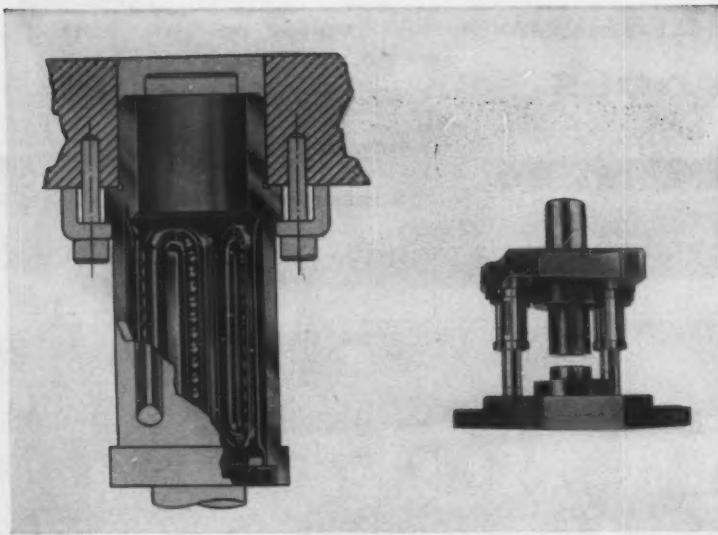
An extremely important feature is the

hydraulically operated clutches, which change pre-selected spindle speeds instantly and automatically.

Other features include: motor mounted vertically on the rear of the machine; a new carriage of rugged design, on which the stop spool is more conveniently located; heavy duty aprons which allow the adaptation of full length lead screw threading attachments, as well as the extremely versatile 2-Dimension (180°) carriage tracer; built-in independent pumps, which supply forced lubrication to the aprons, carriage, and saddle.

Both of these new lathes offer more power, greater accuracy, and easier operation. Write today for details. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



bushings, it is claimed, allow closer fits and maintain alignment, which increase die life and permit longer uninterrupted runs. Periodic lubrication is eliminated and higher speeds are possible. Con-

siderable time is saved in the toolroom, since the bushings prevent all cocking and binding. The punch-holder floats on and off, eliminating die-jacking.

**Circle 590 on Readers' Service Card**

### Linde Oxweld Torch Cuts Metal Thirty Inches Thick

A cutting torch, using natural gas, that can slice through 30 inches of metal in a single pass has been introduced by the Linde Company, division of Union Carbide Corporation, New York City. The new Oxweld C-66 cutting torch has a gas flow of up to 3000

cubic feet of oxygen per hour, 250 cubic feet of natural gas per hour, and an exceptionally wide cutting range from sheet metal to large risers. It will handle any manual cutting job encountered in factories, foundries, steel mills, fabricating shops, and scrap yards.



Oxweld C-66 natural-gas cutting torch removing heavy riser from a manganese-steel casting

Also, it is well adapted for removing large risers. Special applications such as gouging, rivet piercing, and pad and fin washing are also handled easily with the new torch, for which more than forty different nozzles are available.

Interchangeable injectors make it possible to use the torch with either low- or medium-pressure natural gas. Spring-loaded injector assembly provides uniform and thorough mixing of gases and eliminates flashback. All types of cutting jobs can be handled rapidly and easily with this torch because of its tremendous preheat capacity and large flow of cutting oxygen. Extensive field testing is said to have shown that operating costs are comparatively low.

**Circle 591 on Readers' Service Card**

### Polishing-Head Balancer

Torsion balancing unit that provides a wide range of wheel-pressure positions and complete buffing- and polishing-head counter-balancing without the use of weights. This compact unit is now available on all standard buffing and polishing heads made by the Murray-Way Corporation, Birmingham, Mich. It is especially useful when "side" or "up" pressure must be exerted on the work. The unit consists of a heavy coil spring, enclosed in a cast-iron housing, and can be quickly and easily adjusted with a regular shop wrench to any of a wide variety of wheel pressures, from a few ounces to over 100 pounds.

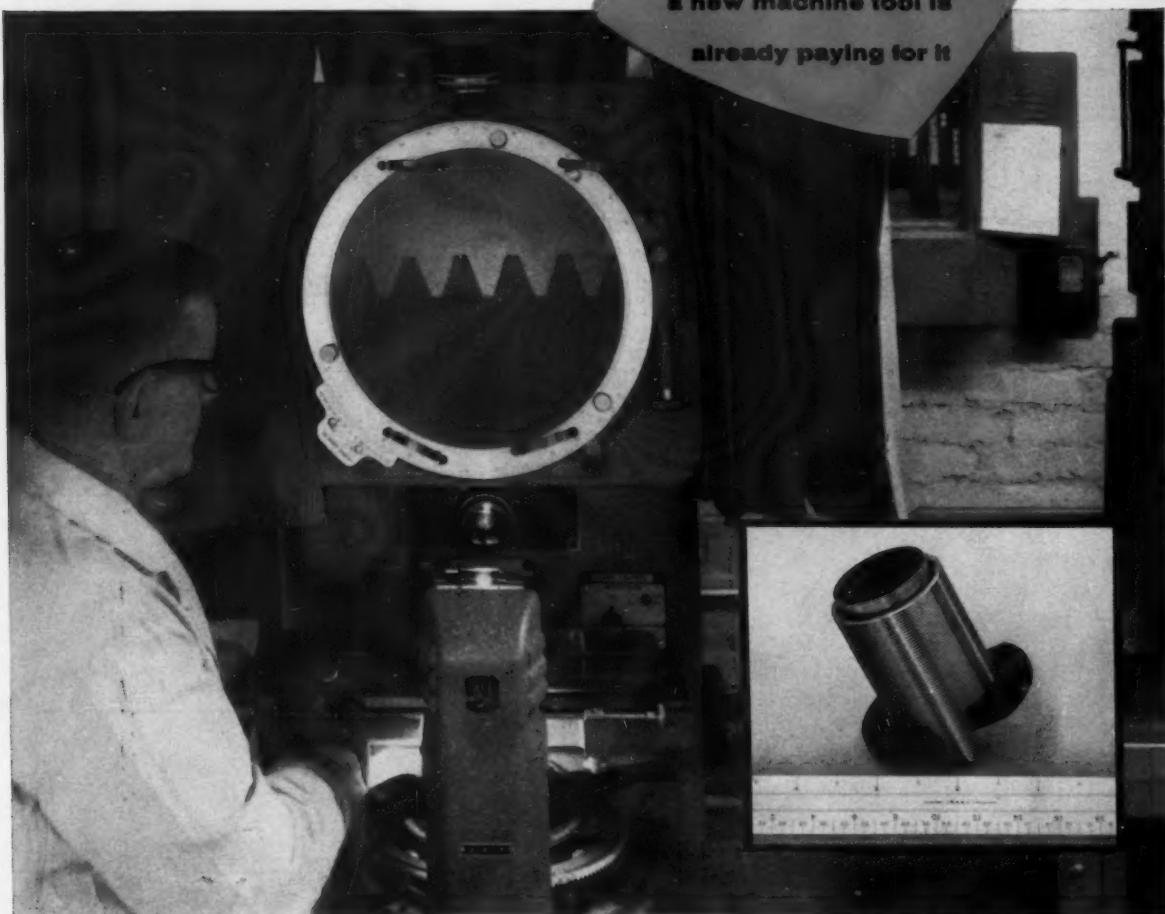
**Circle 592 on Readers' Service Card**

*(Continued on page 210)*



# JONES & LAMSON OPTICAL COMPARATORS

the man who needs  
a new machine tool is  
already paying for it



Unretouched photo (above) shows this cylindrical rack being inspected at 62.25X. Photo, courtesy of Baird-Atomic Inc., Cambridge, Mass.

## 4000% Increase in Inspection Efficiency through use of a J & L Optical Comparator

Baird-Atomic, Inc., Cambridge, Mass., manufacturer of scientific and research instruments needed a rapid and precise method for the quality control measurement and inspection of various components. After experimentation with various types of inspection equipment, a J & L FC-14 Optical Comparator was given a trial. It met all requirements perfectly.

The inspection of a cylindrical rack, heart of the Baird-Atomic Periscopic Sextant, used in advanced aircraft, gives an illustration of the J & L Comparator's efficiency.

The rigid quality control tolerances for this part include: tooth-to-tooth tolerance, .0002"; tooth-to-tooth error, .0003"; com-

posite error, .0003"; pitch dia. within .0005"; concentricity within .0005" TIR.

Adequate inspection and measurement by conventional methods proved laborious and time-consuming: inspection rate was little better than one rack per day. Now, using a J & L FC-14 Optical Comparator, average inspection rate is 42 per day, an increase of approximately 4000%!

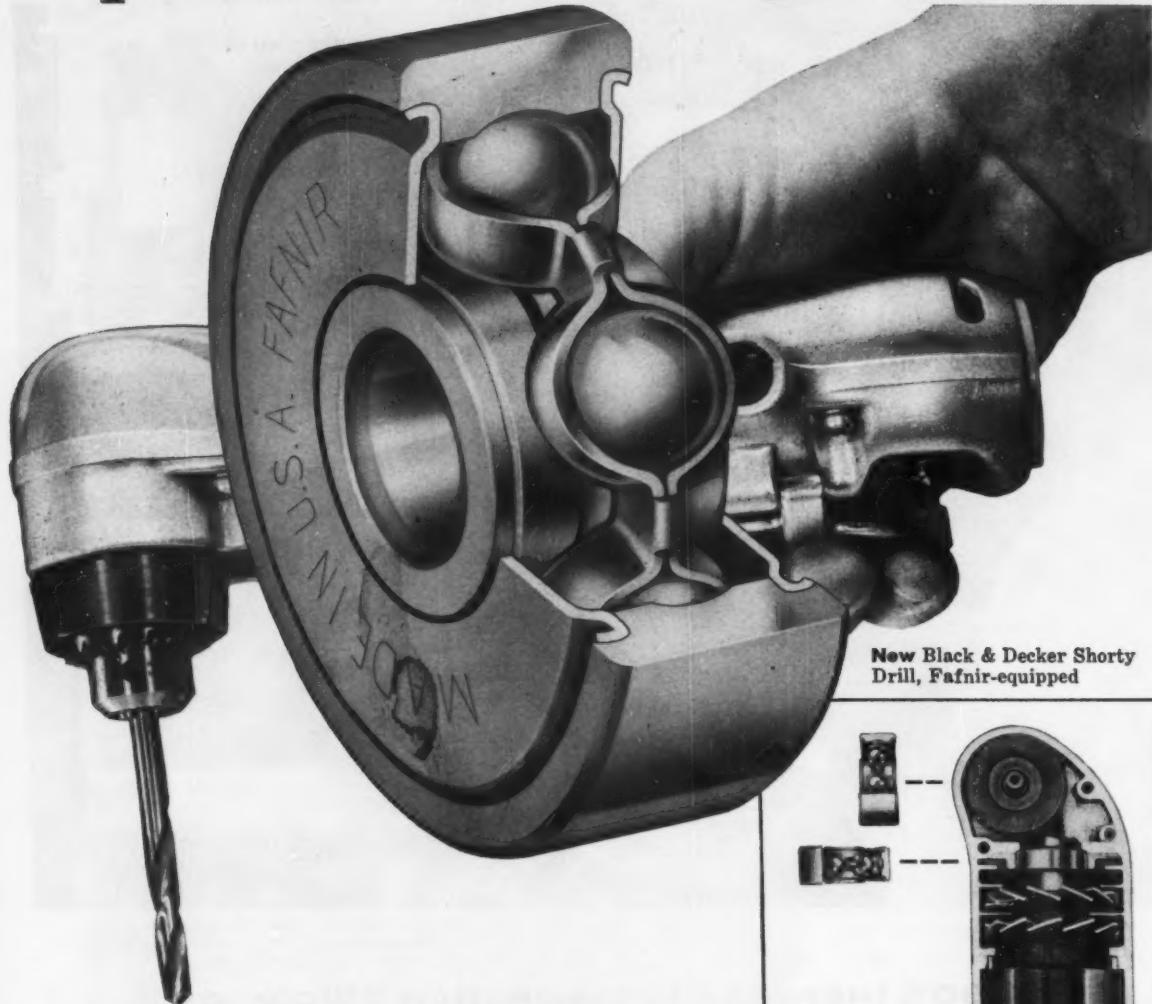
Investigate the possibilities of J & L Comparators in your production set-up. Available in 12 different models, both floor and table types.

Write today for Comparator Catalog 5700. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

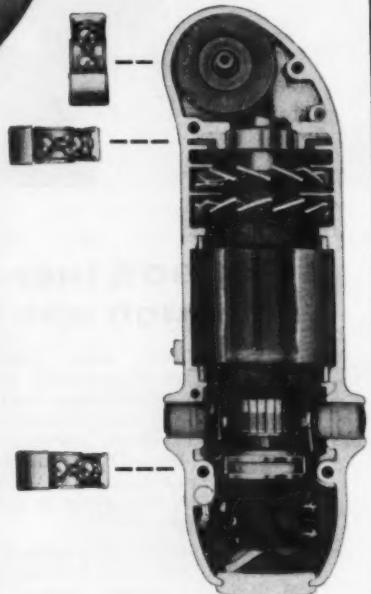
Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

# FAFNIR BALL BEARINGS

## help new drill turn tight corners



New Black & Decker Shorty Drill, Fafnir-equipped



Black & Decker's unique new "Shorty" Drill works where other drills won't . . . in tight spots . . . around corners. In this compact tool, Fafnir Ball Bearings meet space-saving requirements and provide the stamina and precision needed for heavy-duty drilling.

Fafnir extra-small shielded ball bearings are used on the chuck end of the spindle and commutator end of the armature.

A third Fafnir Ball Bearing with Plya-Seal and Shield supports the fan end of the armature. All are permanently prelubricated, with their own built-in protection against grease seepage and contaminants. Thrust loads are adequately sustained by the ball bearings selected.

For the ball bearings you need, write The Fafnir Bearing Company, New Britain, Conn.



**FAFNIR**  
BALL BEARINGS

Fafnir Ball Bearings support armature and spindle in "Shorty" Drill . . . save space, maintenance . . . help keep parts rigidly aligned, true-running.

# NEW CATALOGUES

• Yours for the asking . . . use postcard inside back cover



## Retooling Program

Ingersoll-Rand Co., New York City. Report with slide rule (Forms 5250A and 5290) showing how a planned annual retooling program can increase output of screwdriving, grinding, nut-running, drilling, and similar production operations.

Circle Item 501 on Inquiry Card



## Speed Reducers

De Laval Steam Turbine Co., Trenton, N. J. Catalogue 3810 containing information on the company's Delroyd single- and double-reduction worm-gear speed reducers in ratios up to 4900/1. Tables on horsepower and torque ratings are included.

Circle Item 502 on Inquiry Card



## Turret Lathes

Jones & Lamson Machine Co., Springfield, Vt. Brochure (Form No. GL 6023) on saddle type turret lathes with multiple-spindle headstock. Features include instant speed changes, hydraulic clutches, no gear shifting, and single-speed motor.

Circle Item 503 on Inquiry Card



## Chemical-Processing Compounds

Turco Products Inc., Los Angeles, Calif. Circular presenting Turco's chemical-processing compounds for the metalworking industry. Cleaners, phosphating materials, hot- and cold-tank paint strippers, and rust preventives are described.

Circle Item 504 on Inquiry Card



## Turret Lathes

Gisholt Machine Co., Madison, Wis. Bulletin 1179-B on Masterline Fastermatic automatic chucking turret lathes with FeeDial control. Accessories such as a turret facing attachment, Jetracer, and lead-screw threading attachment are available.

Circle Item 505 on Inquiry Card



## Feed Tables

Master Mfg. Co., Inc., Hutchinson, Kan. Catalogue No. 260 giving details on the company's feed tables and machine beds. Power, hydraulic, and air-hydraulic drives, and machining heads are described. Specifications are included.

Circle Item 506 on Inquiry Card



## Automatic Lathes

Jones & Lamson Machine Co., Springfield, Vt. Brochure featuring three J&L automatic lathes—Model 30 60-degree Auto Tracer, Model 30-2D (180-degree) Auto Tracer, and Model 30 multiple-slide automatic. All have the same basic bridge-bed design.

Circle Item 507 on Inquiry Card



## Cold-Heading Machines

REM Sales Inc., a subsidiary of Robert E. Morris Co., West Hartford, Conn. Bulletin giving descriptions of three Morris-Omega precision cold-heading machines for small and miniature parts and long, thin pins and rivets. Specifications are included.

Circle Item 508 on Inquiry Card



## Power Springs

Sandvik Steel, Inc., Fair Lawn, N. J. Booklet presenting the company's flat spiral power springs, including two variations of a new spring design. Spiral, Cross-curved, stainless, and integral-band types with and without bridle are described.

Circle Item 509 on Inquiry Card



## Carbide Knives

Cowles Tool Co., Cleveland, Ohio. Bulletin No. 601 describing carbide knives for side-trimming and gang-slitting light gages of high- and low-carbon steel, silicon, tin-plate stock, aluminum, brass, copper, and other light-gage materials.

Circle Item 510 on Inquiry Card



## Air Tools

Aro Equipment Corporation, Bryan, Ohio. Ninety-six-page Catalogue No. 64 presenting the complete line of Aro air tools, power motors, and accessories. Included are descriptions of self-feed drilling units, air hoists, and special tools.

Circle Item 511 on Inquiry Card



## Die Assembler

Producto Machine Co., Toolroom Equipment Division, Bridgeport, Conn. Bulletin presenting the Model DA-1-P die assembler, designed for easier and safer handling of dies during assembly or maintenance. Specifications and special features are included.

Circle Item 512 on Inquiry Card

## catalogues . . . bulletins . . . manuals

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### Shaft Seals

Sytron Co., Homer City, Pa. Bulletin No. SS-607 on the company's "M-type" mechanical shaft seals. They are designed to eliminate the leakage of gases or liquids around the rotating shafts of pumps, compressors, mixers, and engines.

Circle Item 513 on Inquiry Card



### Mounting Equipment

Punch Products Corporation, Buffalo, N. Y. Catalogue M on the line of mounting accessories available for use with Unipunch hole-punching and notching units—including templates, T-slotted plates and press-brake bed rails, and ram plates.

Circle Item 519 on Inquiry Card

### Flaw Detector

Magnetic Analysis Corporation, Long Island City, N. Y. Catalogue on the Rototester, which uses the eddy-current technique for flaw detection in magnetic or nonmagnetic, cold-drawn coiled steel wire. Application and operation are discussed.

Circle Item 514 on Inquiry Card



### Microstoning

Taft-Peirce Mfg. Co., Woonsocket, R. I. Catalogue 319 covering Taft-Peirce/Supfina microstoning equipment. The microstoning process and the attachments which make the process available for lathes, milling machines, grinders, etc., are described.

Circle Item 520 on Inquiry Card

### Inserting Tool

Heli-Coil Corporation, Danbury, Conn. Bulletin 770 A describing a miniature power inserting tool which is designed to install a range of small sizes of Heli-Coil stainless-steel wire standard screw-thread and screw-lock inserts.

Circle Item 515 on Inquiry Card



### Cutoff Presses

Federal Press Co., Elkhart, Ind. Bulletin presenting information on a power press designed for the purpose of cutting off roll-formed shapes on the fly. Covered are facts necessary in the selection of the correct press for any specific job.

Circle Item 521 on Inquiry Card

### Compressed-Air Filters

King Engineering Corporation, Ann Arbor, Mich. Catalogue 6000 on a line of compressed-air filters that remove almost all dirt, oil, and water from the air. They are for use with pneumatic instruments and controls, spray guns, vacuum pumps, etc.

Circle Item 516 on Inquiry Card



### Setup Tools

Northwestern Tools, Inc., Dayton, Ohio. Catalogue No. 31 describing component parts for jigs, fixtures, and special machinery. Featured are toggle shoe clamps, cast-iron and aluminum hand knobs, jig feet, and punch-press sets.

Circle Item 522 on Inquiry Card

### Special Production Equipment

Kirkhof Mfg. Corporation, Grand Rapids, Mich. Bulletin E60-1 featuring special equipment to meet the requirements of the metalworking industry. Included are resistance and arc welders, welding guns, and stations, jigs and fixtures, etc.

Circle Item 517 on Inquiry Card



### Punches and Dies

Ring Punch & Die Division, Producto Machine Co., Jamestown, N. Y. Catalogue giving a description of a line of ring and head type punches, a complete range of press-fit and head type stripper bushings, and quill punches in three sizes.

Circle Item 523 on Inquiry Card

### Spindle Shaft Couplings

Ajax Flexible Coupling Co., Inc., Westfield, N. Y. Catalogue No. 70 giving engineering, application, capacity, and dimensional data on the Dihedral spindle couplings and Series D-100 and D-3000 Dihedral gear type flexible couplings.

Circle Item 518 on Inquiry Card



### Rotary Gear Shaver

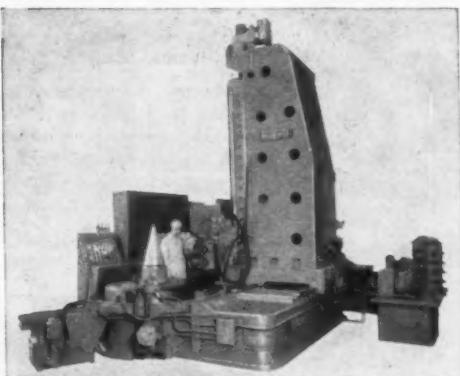
National Broach & Machine Co., Detroit, Mich. Catalogue S60-8 on the company's Red Ring Model GCX 24-inch rotary gear-shaving machine. Principal elements, operating principles, and cutter-head and table for the shaver are described.

Circle Item 524 on Inquiry Card

# Numerical Control Solved These Tough Production Problems

**Problem:** Drill and tap ojival, conical, and cylindrical sections for missile components.

**Solution:** A Barnesdril 2-spindle tape-controlled unit with four-motion-control, including a head that tilts to 15° plus or minus off horizontal center. Capable of handling parts to 36" diameter and 72" high, this unit gives  $\pm .003"$  positioning accuracy with repeatability to  $\pm .0005"$ . Holes can be spaced



evenly or unevenly. Standard 8-channel tape also controls tool changes, coolant selection, rapid approach and return, sensing, etc. Rotary table indexes 360°.

**Problem:** Reduce set-up and machining time on jet engine casings requiring 3 different hole sizes and up to 4 operations per hole.

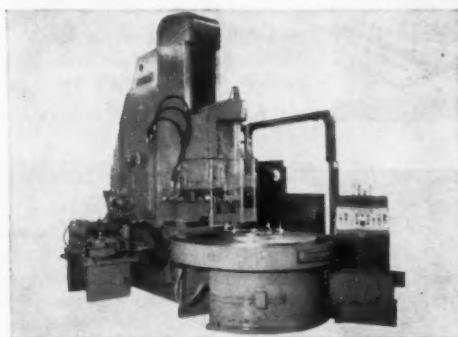
**Solution:** A 4-spindle, 2-motion Barnesdril numerically controlled unit completes rough drilling, rough facing, finish boring, and generating front and back parallel faces on 248 holes in 4½ hours . . . a 74% savings



in set-up and machining time. Individual spindles are tape-controlled to operate from 3 different feed-out ratios, entirely eliminating tool changes. The machine has the ability to select exact position, hole size, and cutting depth quickly, and with extreme accuracy. Positioning is guaranteed to  $.003"$ , depth to  $.001"$ , and repeatability to  $.0002"$ , making it a highly flexible production machine for cylindrical parts up to 50" in diameter and 40" in height.

**Problem:** Cut production costs on a variety of boiler plate and bolt circle work.

**Solution:** A Barnesdril numerical control unit cuts production time by 47%. This



is a single-spindle drilling machine with vertical spindle travel and a rotary indexing table with capacity to 50" diameter and 42" in height. Operations include combination drilling-countersinking, drilling-counterboring, straight drilling, reaming, counterboring, and countersinking.

**Problem:** Informing every cost-conscious metalworking executive of other Barnesdril advances and advantages in tape control machining.

**Solution:** Write, wire, or call for complete information. We have detailed reports on the above machines.

**BARNESDRIL**  
PRODUCTION UNITS

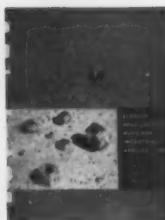
**BARNES DRILL CO.**

820 Chestnut St., Rockford, Illinois

Detroit Office: 13121 Puritan Avenue

## catalogues . . . bulletins . . . manuals

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### Self-Locking Nuts

Standard Pressed Steel Co., Jenkintown, Pa. Bulletin (Form 2339) covering the Flexloc line of self-locking standard and clinch nuts, including specifications for thin and full-height lock-nuts, the microsize series, and the 8-pitch series.

Circle Item 525 on Inquiry Card



### Drilling Machine

Burgmaster Corporation, a division of Burg Tool Mfg. Co., Gardena, Calif. Circular on the bench-model Burgmaster turret drilling machine. Operations include center drilling, drilling, tapping, spot-facing, counterboring, countersinking, etc.

Circle Item 526 on Inquiry Card



### Cutting Machine

Mitts & Merrill, Saginaw, Mich. Circular on the M&M giant keyseater vertical cutting machine. Accessories include: tilting table, combination tilting table and indexing plate, oil-groove cutting device, and special expansion bushings.

Circle Item 531 on Inquiry Card



### Transfer Presses

Baird Machine Co., Stratford, Conn. Brochure giving information on Baird's complete line of transfer presses. The five standard machines and their applications for the high production of stamped and drawn parts are described in detail.

Circle Item 532 on Inquiry Card



### Steel Pipe and Tubing

Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa. Bulletin T-467 on fifteen steels widely used in high-temperature service. Included is a chart giving tensile properties, thermal conductivity and expansion, creep strength, etc.

Circle Item 527 on Inquiry Card



### Shaft-Mounted Reducer

Airborne Accessories Corporation, Hillside, N. J. Bulletin presenting the Roto-Mission rotating transmission, which features control flexibility, high torque capacity, and compact size. It is applicable to hoists, elevators, conveyors, etc.

Circle Item 533 on Inquiry Card



### Grinding and Turning Machine

Frauenthal Division, Kaydon Engineering Corporation, Muskegon, Mich. Bulletin 560 describing vertical machines for standard and contour grinding, turning, and boring operations. Included are four standard series and custom machines.

Circle Item 528 on Inquiry Card



### Ribbon- and Wire-Forming Machines

Baird Machine Co., Stratford, Conn. Catalogue No. 40 describing the engineering features and production capabilities of Baird's automatic high-speed ribbon- and wire-forming machines, known as four slides. Complete specifications are included.

Circle Item 534 on Inquiry Card



### Grinding Tools

Dumore Co., Racine, Wis. Catalogue 60-FL containing details on portable precision grinding tools and small-hole drilling equipment—toolpost grinders, flexible shaft tools, quills, Micro-Drills, high-speed drill presses, automatic drill heads, etc.

Circle Item 529 on Inquiry Card



### Numerical Positioning Controls

Electronics Division, Rheem Mfg. Co., Los Angeles, Calif. Catalogue giving details on the company's numerical positioning controls for machine tools. Featured are the Rheem multiple- and two-axis consoles. Diagrams and specifications are included.

Circle Item 535 on Inquiry Card



### Welder Travel Unit

Lincoln Electric Co., Cleveland, Ohio. Bulletin 5205.2 describing operating features, construction details, and application information on a new trackless carriage—called Squirtmobile—for Lincoln's semiautomatic Squirt Welder.

Circle Item 530 on Inquiry Card



### Milling Machine

Kearney & Trecker Corporation, Milwaukee, Wis. Bulletin VBT-60 covering the features of the Milwaukee-Mil vertical-head bed type milling machine (Model 3006). A diagram is included, along with descriptions of standard and extra equipment.

Circle Item 536 on Inquiry Card

## catalogues . . . bulletins . . . manuals

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### Compressed-Air Units

Hannifin Co. (division of Parker-Hannifin Corporation), Des Plaines, Ill. Bulletin 0400-B1 presenting Crown compressed-air preparation units—airline lubricators and filters, self-drain filters, air-pressure regulators, and "combo" units.

Circle Item 537 on Inquiry Card



### Milling Machine

Sundstrand Machine Tool, division of Sundstrand Corporation, Belvidere, Ill. Folder giving information on the company's new universal automatic thread-milling machine. It features sine-bar adjustment for threads up to 1/2-inch lead.

Circle Item 543 on Inquiry Card



### Screwdrivers

Gardner-Denver Co., Quincy, Ill. Catalogue containing a description of the company's 12B-3 series screwdrivers, with a choice of pistol-grip or offset handles, and short head. Bit, finder, and bit-holder information is also given.

Circle Item 538 on Inquiry Card



### Gear-Inspection Machines

National Broach & Machine Co., Detroit, Mich. Catalogue C60-8 on Red Ring gear-inspection machines, including Model GRF automatic gear checkers and classifiers, Models GRJ and GRH gear-rolling fixtures, and Model GSC gear speeders.

Circle Item 544 on Inquiry Card



### Lubricant

Bel-Ray Co., Inc., Farmingdale, N. J. Brochure on a white lubricant called "No Flame" grease, which is nonflammable, nonmelting, noncarbonizing, noncorrosive, and withstands extreme pressure. Unretouched photographs of laboratory tests are included.

Circle Item 539 on Inquiry Card



### Hobbing Machine

Fellows Gear Shaper Co., Springfield, Vt. Catalogue presenting information on the Fellows-Pfauter P400 high-speed hobbing machine. Working capacity, machine and hob dimensions, and infinitely variable speeds and feeds are included.

Circle Item 545 on Inquiry Card



### Die-Casting Machines

Cleveland Automatic Machine Co., Cincinnati, Ohio. Bulletin describing the line of Cleveland high-pressure hydraulic die-casting machines—100-, 250-, 400-, 650-, 850-, 1000-, and 2000-ton models. Details on optional features are included.

Circle Item 540 on Inquiry Card



### Resistance Welders

Federal Machine & Welder Co., Warren, Ohio. Bulletin No. BT-6 covering details of Federal's basic types of resistance welders. Bench models, rocker-arm spot welders, heavy-duty press type, and flash butt and seam welders are included.

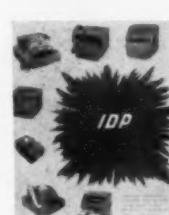
Circle Item 546 on Inquiry Card



### Jig Borer

Moore Special Tool Co., Inc., Bridgeport, Conn. Brochure featuring details on the company's new Model No. 1 1/2 jig borer, which combines the features of the No. 1 and No. 3 jig borers and incorporates a new three-position clutch.

Circle Item 541 on Inquiry Card



### Data-Processing Systems

Friden, Inc., San Leandro, Calif. Booklet on over a dozen major data-processing systems which are controlled automatically by Friden business machines. Presented are the Flexowriter, Computyper, Teledata, Collectadata, and Selectadata units.

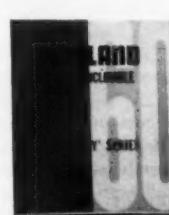
Circle Item 547 on Inquiry Card



### Drill Stops

Wohlnip Products, Inc., East Orange, N. J. Bulletin No. 110 giving a description of the company's precision Micro Drill Stops. They are used on drill presses, radial drills, lathes, turret lathes, hand and automatic screw machines, and boring machines.

Circle Item 542 on Inquiry Card



### Presses

Cleveland Punch & Shear Works Co., Cleveland, Ohio. Folder presenting the "Sixty Series" open-back inclinable presses, which are available in a wide range of standard sizes. Described is the Cleveland drum type friction clutch and brake.

Circle Item 548 on Inquiry Card

## catalogues . . . bulletins . . . manuals

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### Power Chucks



PowerGrip, Inc., Rockfall, Conn. Catalogue 5760 containing a description of the company's universal, air- or hydraulic-operated power chucks. Among their features are extra-wide jaw and cam bearing surface, clear center hole, and serrated jaws.

Circle Item 549 on Inquiry Card

### Drill Presses and Lathe

South Bend Lathe, Inc., South Bend, Ind. Bulletin 6015 featuring the CD 400F and CD 600B drill presses and CL 644Y lathe. Accessories—drill-press table elevator, collets, turrets, grinding attachments, tool-holders, and tool-slides—are included.

Circle Item 555 on Inquiry Card

### Turret Lathe



Sheldon Machine Co., Inc., Chicago, Ill. Bulletin covering the Sheldon 3R turret lathe, equipped for turning, chucking, and single-point threading, in addition to standard turret operations. Specifications and dimensional data are given.

Circle Item 550 on Inquiry Card

### Comparators

Van Keuren Co., Watertown, Mass. Buyers catalogue and price list (36B, Section "TC") describing the company's thread-ring comparators (three models) for checking full form and pitch diameter of external threads up to 0.750 inch in diameter.

Circle Item 556 on Inquiry Card

### Shapers



Havar Mfg. Co., St. Paul, Minn. Bulletin 8-60 describing the company's Shape-Rite Hy-Duty-model shapers with 8-inch stroke. Standard equipment includes swivel table, swivel-base vise, toolpost wrenches, cranks, and motor-drive arrangements.

Circle Item 551 on Inquiry Card



### Machine Tools



Taft-Peirce Mfg. Co., Woonsocket, R. I. Catalogue 318 presenting a description of the company's line of surface grinders and lapping machines. Features that have been added, as well as many accessories and attachments, are discussed.

Circle Item 552 on Inquiry Card



### Hydraulic Feed Units



Buhr Machine Tool Co., Ann Arbor, Mich. Brochure on a new concept in hydraulic way type feed units, which are available in four sizes to meet every job requirement and can be equipped with Buhr's integral-motor or standard flat platen.

Circle Item 553 on Inquiry Card



### High-Speed Hopper



Count-O-Matic, Inc., division of U. S. Engineering Co., Long Island City, N. Y. Brochure B-31 featuring information on the company's Hoppermatic, a standardized high-speed hopper which is completely adjustable for size, shape, and count.

Circle Item 554 on Inquiry Card



### Boring and Drilling Machines

Jones & Lamson Machine Co., Thread Tool Division, Springfield, Vt. Booklet featuring a line of J&L small precision machine tools. The model 6 boring machine, Model 6B gun-drilling machine, and a small thread grinder are covered.

Circle Item 559 on Inquiry Card



### Square-Head Cylinder

Tomkins-Johnson Co., Jackson, Mich. Bulletin SH-6-60 featuring the company's new interchangeable, high-pressure square-head cylinder. Included are general and technical information, model and mounting dimensions, and specification charts.

Circle Item 560 on Inquiry Card

# GREATER TURNING ACCURACY

**HIGH SPEED PRODUCTION** with tolerances held to .0002 in. is achieved at the Axle Division of

**EATON MANUFACTURING COMPANY**,

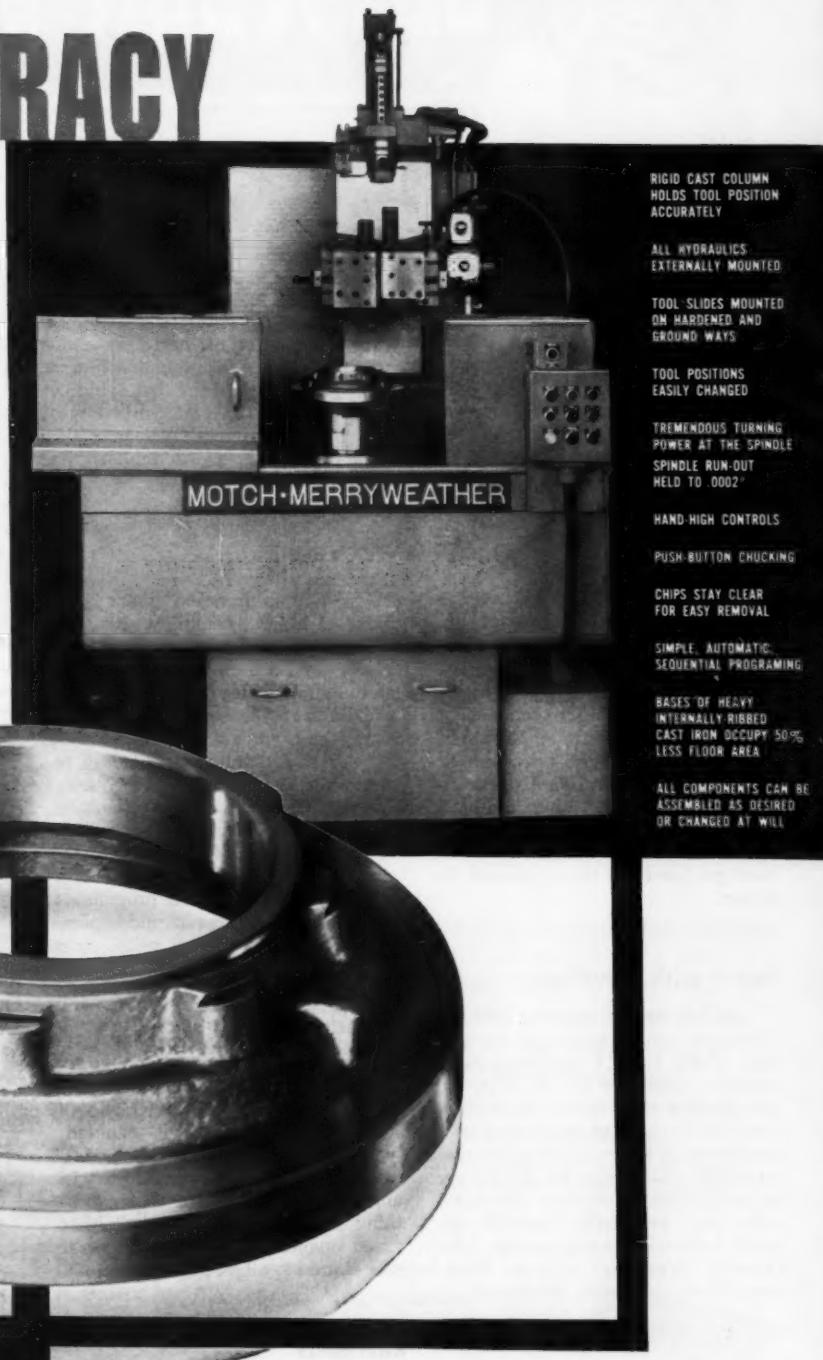
Cleveland, on finish turning the 7.388 in. pilot diameter and boring the 6.378 in. inside diameter of a 2-speed drive gear for truck axles. Furthermore, on the amazing new

**MOTCH & MERRYWEATHER VERTICAL TURNER**

cycle time was held to 45 seconds. Greater rigidity at the spindle, greater turning power, fully automatic control of the cutting tool is the answer.

For production speed with accuracy you just can't beat the Motch & Merryweather

**VERTICAL TURNERS!**



**MOTCH AND  
MERRYWEATHER**

1250 East 222nd Street CLEVELAND 17, OHIO

*Check the facts! Learn how the Vertical Turner, custom-assembled from production-made components to effect huge savings in capital investment, also makes great savings through improved accuracy and higher production rates. Write today for catalog.*



# BETWEEN GRINDS

By E. S. Salichs

## Well-Wishing

The year '60 having rolled around—and, it seems, with more momentum than ever—we again wish all of MACHINERY's readers a most Merry Christmas and Happy New Year; and while we are at it, we wish the whole world a Peaceful '61.

## Fasten in Fashion

Glamour treatment of six household tools, designed to appeal to the ladies who wield them, is an innovation reaching the shops just in time for the man without the money for mink to give his wife for Christmas. Of course she might open the attractive Carib Coral tool chest, remove the lovely chromium and black hammer, and use it on her sly-like-a-fox husband who thought he could thus get her to fix things around the house.

## Say It with Satellites

The Bell System recently bounced telephone conversations off the surface of the Echo I communications satellite (sponsored by the National Aeronautics and Space Administration). Bell scientists are excited over the success of the experiment because a satellite system may be the answer to the growth of overseas telephone calls and eventually provide for world-wide television programs. Like Oriental Westerns, African Westerns, South American Westerns?

## Really Caught by Camera

We read about a camera and television shop in Sweden which had been robbed seven times. The owner,

having lost his patience as well as the good will of his insurance company, rigged up an automatic camera to go off the instant the shop window was smashed. The plan worked, and now the police have a picture of the thief in the near-eighth robbery; he was in a rut anyway.

## Peephole at Picatinny

In a soundproofed room atop Navy Hill, a machinist gingerly lowers a rapidly spinning drill until it bites into a finely machined piece of metal. He holds his breath . . . and listens." Where are you? In the model shop of the Liquid Rocket Propulsion Laboratory, according to a news release from the Picatinny Arsenal. It describes one operation in which the operator was drilling holes as small as 0.013 inch in diameter in a rocket-engine injection assembly through which propellants and oxidizers are forced under pressures up to 1200 pounds psi.

## Wonderland Woes

Semiconductor devices, no larger than pinheads, are contributing to the age of miniaturization which will influence the lives of all mankind, we just read. Now what is the word for the opposite—monsterization? In any case, it does seem that everything made today has to be either much smaller or much larger than it was. Bound to affect our equilibrium.

## Rich Rods

Instead of working on hot rods, there is now a trend for youngsters to rebuild or "customize" cars. One young man, with the help of his

dad, recently won eleven first places for his entry in a competitive show. About \$5000 went into making his standard car a deluxe model. The front was lowered 3 inches and the back 5 inches; secret buttons were installed to electrically open the doors, which no longer have handles; and enough chromium was added to the body and engine to create a real need for dark glasses. A soft-drink bar, a hi-fi set, and a telephone lent the car more luxury, not to mention the custom upholstering, even of the trunk compartment. When the young man was asked in an interview if he had any other hobbies, he answered simply, "Yes, girls." Which figures.

## Gourmet Gertie

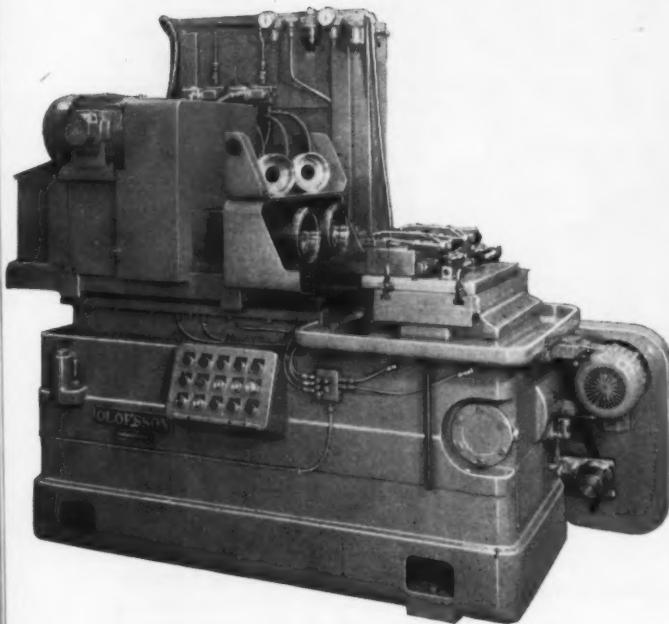
Among the gadgets G-E appliance engineers have been demonstrating in tomorrow's kitchen is an automatic plastic dishmaker. The dishes are all dirty or have been broken; the housewife needs a dish. So she dials the shape desired, presses a button, waits one minute. Out comes a cup, bowl, or plate. Decisions, decisions—shall she whip up cup and/or cakes; a bowl and/or soup; a plate and/or spaghetti? Exhausted from all this, she gets to dine out.

## Petrol by the Piece

In searching for petroleum, geologists now employ air-borne photographers who take thousands of pictures of sections of the earth under study. The geologists then piece the photographs together in jigsaw fashion to form a mosaic which may indicate to trained eyes the whereabouts of potential oil-bearing formations. Takes a whole wall, though, not just the dining-room table.

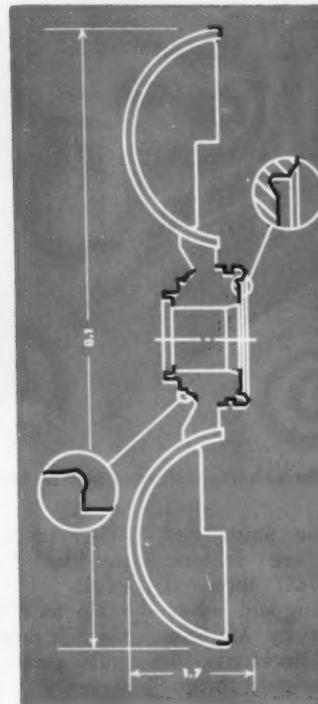
Announcing the

# NEW OLOFSSON MODEL 41, AIR-OPERATED CAM-CONTROLLED MACHINE



**Bores, Turns, Contours  
and Faces with new  
efficiency and economy**

Designed for generating accurate contours mechanically, the Olofsson Model 41 brings new efficiency and economy to boring, turning, contouring and facing operations like those diagrammed above. Its low height to width ratio of spindles to ways provides maximum stability and smoothness to *repetitive* machining operations. And, on multiple operations it is necessary to check just one dimension from each tool used, all other dimensions will be in relation.



#### Part: TORUS

#### Operations Performed:

Facing, chamfering, boring, undercutting and grooving.

#### Rate of Production:

170 pieces per hour (at 80% efficiency).

ONE MACHINE  
FOR EACH  
SIDE OF  
PART. TWO  
SPINDLES  
PER MACHINE.

The cam-controlled stroke is 4" on both main and cross slides. Cams are mounted on the same shaft, and both table slide and cross slide are in *direct contact* with their respective cam. No linkage is involved. Both cams and cam followers are completely submerged in oil; can be quickly and easily changed.

All machine functions are electrically interlocked. Air power supply is from 70 p. s. i., minimum.

Your Olofsson representative will be glad to suggest profitable applications for your operation. Call him, or contact Olofsson in Lansing.



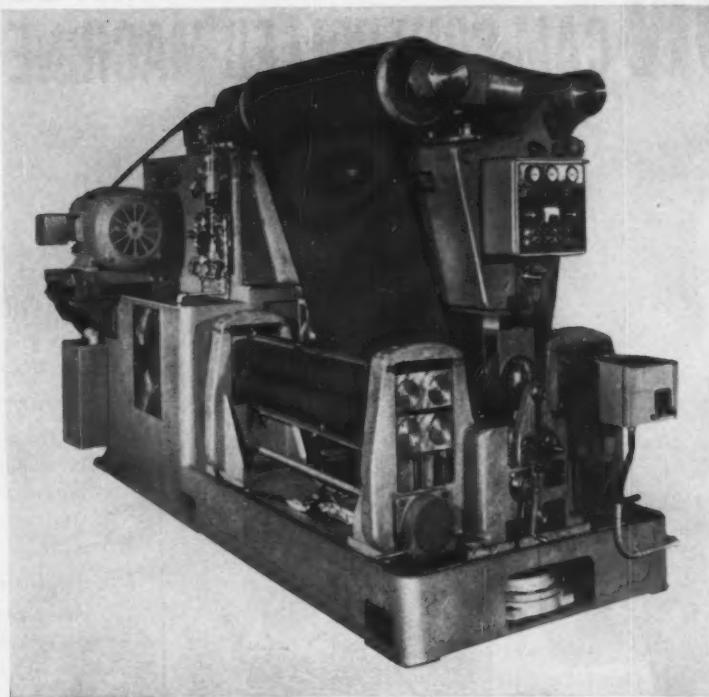
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2729 Lyons Avenue, Lansing, Mich. Phone TURNer 2-0265

Descriptive literature on the Model 41  
is yours for the asking. Write today.

Manufacturers of  
precision boring and  
special machinery



## Mattison abrasive-belt Grinder with Three-Roll Head



Abrasive-belt grinder with three-roll head built by Mattison Machine Works

Size control, fine finish, and high production are features claimed for No. 457 three-roll abrasive-belt grinding and polishing machine built by Mattison Machine Works, Rockford, Ill. This machine is designed to provide the compactness needed for in-line installations (such as for coil grinding) without loss of rigidity, cutting qualities, or required power for the production of accurate fine-finish work. A serrated contact roll of the proper hardness supplies the grinding or polishing action. Another roll aligns and flexes the belt, and a third roll drives the belt, pulling it between the work and the contact roll. This arrangement imparts a smooth surface finish, which is said to be free of motor pulsation or chatter marks.

Other special functions of the three-roll head include: automatic tensioning and tracking of long, 14-foot belts which provide more time for cooling, yet are easy to replace; new manual control that instantly switches billy roll to floating or fixed position; and

closer pinch-roll spacing, which provides for grinding shorter work.

Up to 150 hp is provided for the belt drive to achieve positive grain penetration and increased accuracy. The tensioned cast Meehanite main support arm is designed to assure positive, close grinding control with no vibration. Grinding contact is established to within only 1/4 inch of a sheet's lead end. A photoelectric cell senses the leading edge of a sheet as it enters through the feed rolls. The electric eye pickup actuates a control mechanism which raises the billy roll and brings the sheet into contact with the abrasive belt.

The three-roll head, including rolls, belt, tracking and tensioning devices, and electronic timer, is designed as a unit which can be used on pinch roll machines, reciprocating table machines, conveyor type applications, and way and column combinations. Large windowed doors allow easy access to all functional parts. An important advantage is the ability to

accurately grind a wide variety of work requiring critical thickness tolerances. The machine is adapted for both wet and dry grinding. It has proved exceptionally efficient in grinding, polishing, and sizing honeycomb, sheet stock, chip board and other flat wood products, glass, and high-production small flat work such as motor laminations.

Belt widths are 36, 48, 60, and 72 inches. All operating controls are located at the front of the machine. A load ammeter indicates the amount of grinding load, permitting the operator to determine the point of best grinding efficiency, and to maintain this point by adjusting pressure on the billy roll to proper power consumption.

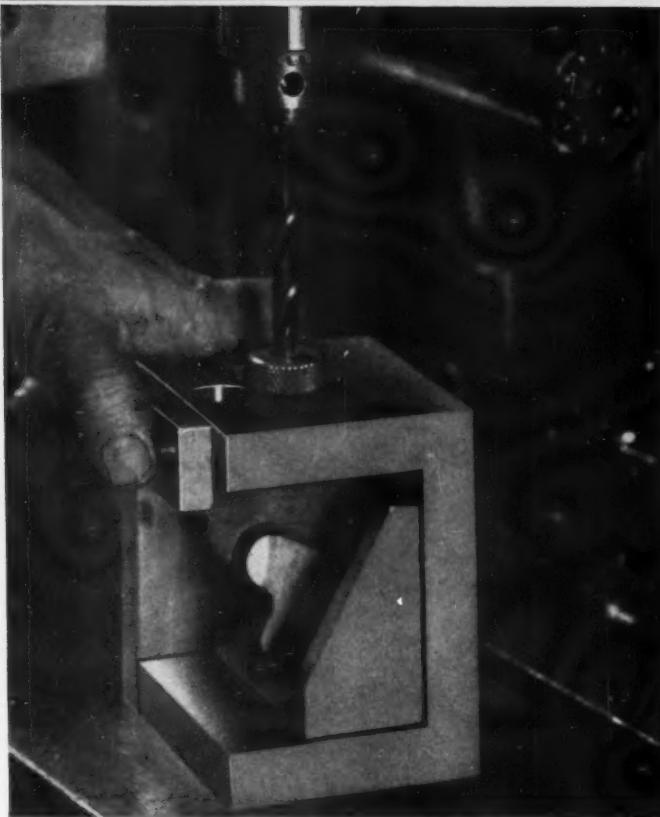
Circle 606 on Readers' Service Card

## "Cut-Machining" Equipment for Tool Reclaiming

The Wallace Supplies Mfg. Co., Chicago, Ill., has brought out a toolroom "Flexi-Modular" cutting unit, Fig. 1, for use in reclaiming cutting tools of the types shown in Fig. 3. This machine can also be used for rapid cutting of tubes and bar stock of all shapes. The operator can slice through the hardest materials, cutting the smaller tools with a simple chop-



Fig. 1. Tool-reclaiming machine introduced by Wallace Supplies Mfg. Co.



## Now—A Low-Cost Way to Build Jigs & Fixtures!

### PRE-MACHINED MICRON SECTIONS PUT YOUR TOOLROOM JOBS ON A PRODUCTION BASIS

Next time you need fixtures for short-run milling or drilling jobs, use Ex-Cell-O Micron Sections to produce them quickly and at low, low cost!

High tensile strength cast-iron Micron Sections give you inbuilt accuracy plus substantial savings in design and building time; you eliminate welding, cut machining time.

Simply select the desired shape and size from Ex-Cell-O Bulletin B-5914, and specify the length required; we'll deliver the sections you need—pre-machined and ready for minor detailing.

Micron Sections are available from stock by ordering through your local Representative or direct from Ex-Cell-O. Send for data sheet and price list today.

#### BRIEF SPECIFICATIONS

Cut to order from 25" lengths. Wall thicknesses from  $\frac{1}{8}$ " to  $1\frac{1}{4}$ ". Width and height from 3" x 3" to 8" x 8". Machined square and parallel within .005" per foot on all surfaces except ends and interiors of hollow shapes.

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EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • ATOMIC ENERGY EQUIPMENT • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

#### Machinery Division

**EX-CELL-O**  
CORPORATION  
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Fig. 2. (Left) Wallace toolroom cut-machining unit setup for cutting large tool-steel parts

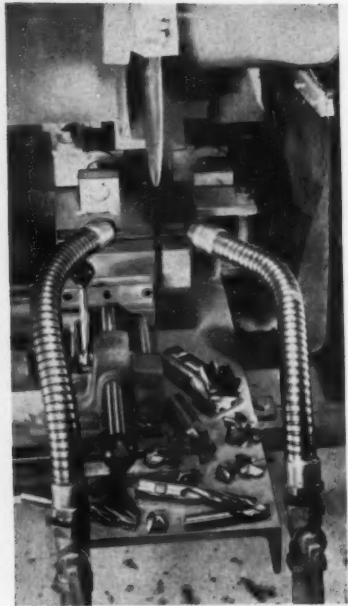


Fig. 3. (Right) Close-up of machine illustrated in Fig. 1, showing reclaimed tools

ping action. To assure the same fine quality on larger tool-steel parts he can use a setup such as shown in Fig. 2, to employ an oscillating movement as he takes the cuts.

The general view of the unit (front splash guard removed), Fig. 1, shows the simplicity of construction. Sediment—or sludge—is trapped in two stages with the separate coolant-pumping system.

Large wheels—14 inches in diameter—are used to reduce the frequency of wheel changing. Rubber-bonded wheels are employed which operate wet and at speeds starting at less than 10,000 sfm. For the best results, six to ten seconds should be allowed for each square inch of tool steel cut.

Circle 608 on Readers' Service Card

### Ellipti-Bur Deburring Tool

Deburring and chamfering of the angularly drilled holes in automotive crankshafts, always a troublesome problem for automobile manufacturers, is said to have been solved by the use of an Ellipti-Bur tool brought out by the Nobur Mfg. Co., North Hollywood, Calif. This tool has been developed especially for applications involving irregular hole surfaces like those obtained by drilling into a cylindrical surface or an angular plane. It automatically follows the hole configuration and produces a chamfer of relative uniformity and symmetry.

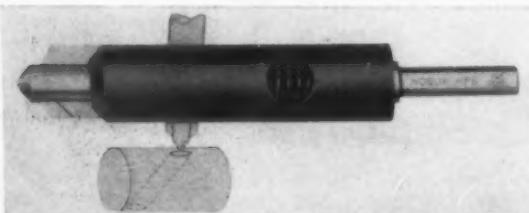
Neither jigs, fixtures, or skilled operators are required to use the tool. A conical pilot is easily directed in the hole using a low-speed, portable air-drill motor.

The deburring operation may be performed as parts progress along a conveyor line or while they are palletized between successive machine stations.

Circle 613 on Readers' Service Card

### Small-Size, Pneumatic Horizontal Grinder

The smallest of a family of general-purpose horizontal grinders has just been introduced by the Buckeye Tools Corporation, Dayton, Ohio. This tool is only 10 inches long and weighs 40 ounces. It is made in the throttle-controlled Type 31G-520, which has a lever as shown in the illustration, and in a lock-button type designated 720. These air tools are used primarily in die grinding, but they are well-suited for deep-hole grinding and may be adapted for



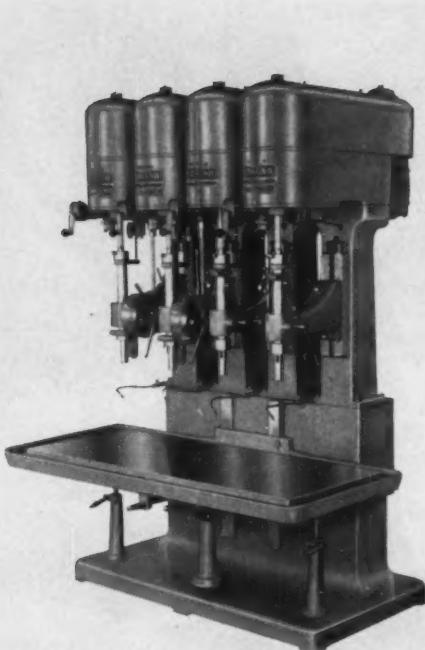
Ellipti-Bur deburring tool developed by Nobur Mfg. Co.



Buckeye small-size pneumatic horizontal grinder

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Infinitely Variable Spindle Speeds  
available in spindle combinations from  
1 to 8 with 8", 12" or 15" overhang.  
Capacity 1" in cast iron.  
For complete specifications write for  
Bulletin 140R

Also EXTRA HEAVY DUTY MODEL 4F,  
Capacity in cast iron to 1 1/4".  
1 to 4 spindles, 12" overhang.  
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Special Contract Job work  
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## EDLUND MODEL 2G

Gun Drilling Machine with

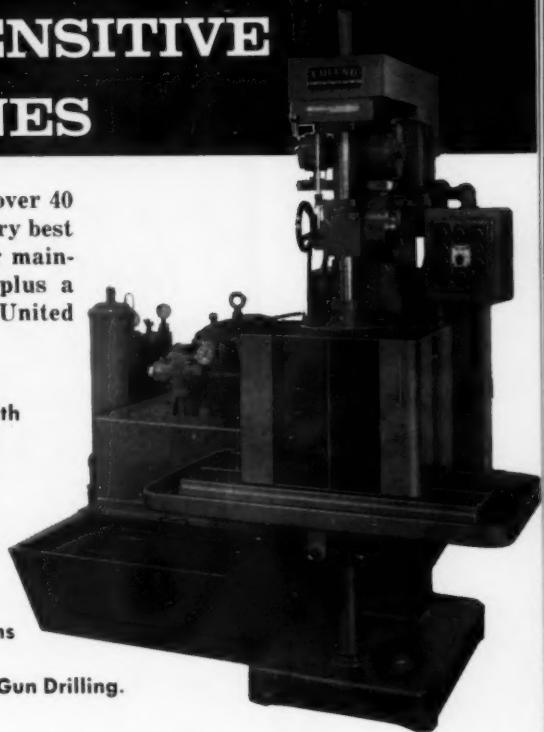
Edlund Model 2HPC High  
Pressure Coolant System

The most efficient unit  
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## EDLUND MODEL 1F

High Speed Sensitive Drilling  
Machine for small parts and light  
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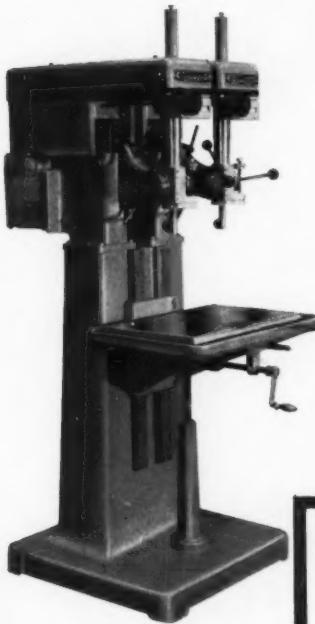
1 to 6 spindles, 7" and 10" overhang.

Capacity in cast iron to  $\frac{3}{8}$ ".

Speeds to 10,000 RPM.

Pedestal or Bench types.

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## Also MODEL 1 1/2 F

1 to 6 spindles, 7" and 12" overhang.

Capacity to  $\frac{5}{8}$ " in cast iron.

Speeds to 6,000 RPM.

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MOBILE-LIGHT,  
TAKEOFF-TOUGH  
WITH  
**N-A-XTRA**  
**HIGH-STRENGTH STEEL**

A battlefield might be anywhere. Wherever it is, there may be a need for the new 10,000-pound, 36-foot Sperry-Rand U.S. Army Sergeant missile. That's why the launching station on which the missile is assembled, aimed and fired must be light enough to be transported by land, sea or air. Yet it also has to be rugged and strong enough to assure the launcher's availability for subsequent firing.

N-A-XTRA steels meet all the conditions of light weight, high strength and impact resistance. Pound for pound, they're nearly three times stronger than mild carbon steel. They are used, not only in this mobile missile launcher, but in many other defense products and in commercial equipment such as earth-moving vehicles, heavy machinery and pressure vessels.

Fabrication qualities are an N-A-XTRA bonus. Even at extreme subnormal temperatures, they remain tough and readily weldable. Conventional methods—cold forming, gas cutting, shearing and machining—give superior results, too. For further information, write Product Development Department, Great Lakes Steel Corporation, Detroit 29, Michigan.



A PRODUCT OF

**GREAT LAKES STEEL**  
Detroit 29, Michigan

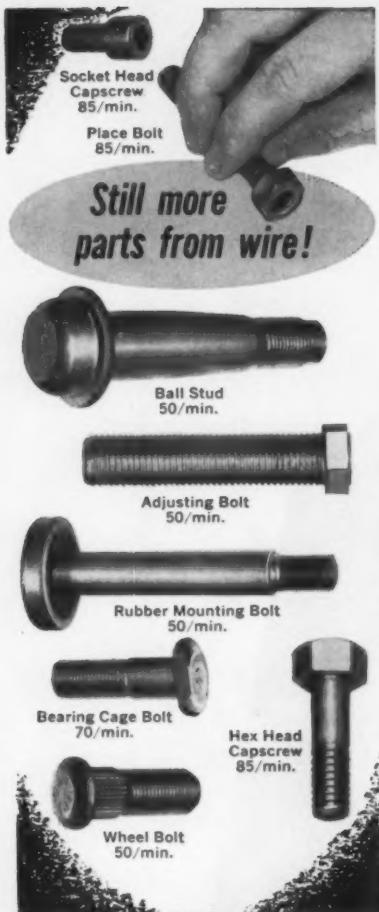


Quenched and tempered N-A-XTRA, the best low carbon extra-strength alloy steels you can buy, are available in four levels of minimum yield strength, from 80,000 to 110,000 psi. They are tough at normal and subnormal temperatures and can be readily and reliably welded. Sizes range from  $\frac{1}{8}$ " to 1" thick, up to 72" wide and up to 35' long.



Look for the STEELMARK  
on the products you buy; place  
it on the products you sell.

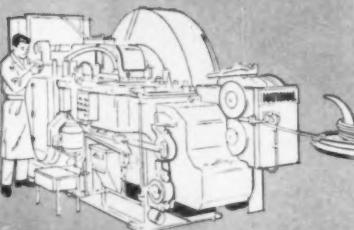
Great Lakes Steel is a Division of **NATIONAL STEEL CORPORATION**



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4,200 PARTS PER HOUR!

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use with rotary files, cutters, and midget mills. Design features include: all-steel housing with steel front head for additional strength and resistance to abrasive wear, shielded bearings to improve grease retention and prevent possible entry of foreign particles, and rotatable baffle ring and muffler developed to reduce the noise level.

Both tools operate at 20,000 rpm, require 1/4-inch hose and 90- to 100-psi air pressure, have 1 5/16-inch outside-diameter front heads, and will accept an organic wheel 1 3/4 inches in diameter. Anyone of the following accessories is available at no extra cost: 1/8-, 3/16-, or 1/4-inch long or short collets; 3/8- or 1/2-inch short collets; 1/8-, 1/4-, or 3/8-inch extension spindles; and a 5/8-11 spindle adapter.

Circle 614 on Readers' Service Card

responsible for the size reduction but has also improved reliability through longer operational life, lower power consumption, and negligible heat generation. Each control unit is fail-safe both pneumatically and electrically. Loss of either air pressure or electrical power automatically retracts the grinding wheel. Each unit has built-in testing facilities to permit rapid tracing and isolation of trouble independent of machine operation. Only one master is required for setting to size. Units may be obtained separately or with tooling required for the particular type and make of machine involved.

Circle 615 on Readers' Service Card

### "Zero Spindle" for Inspection Work



### Transistor-Operated Machine Control Unit

Transistorized dimensional-control unit available for use with various types of gage tooling to provide automatic control of plunge-cut and internal grinding operations. Four basic models, announced by Federal Products Corporation, Providence, R. I., cover single- or double-limit control of internal or external grinders.



These compact units are said to be capable of a high degree of accuracy. The use of transistors, instead of vacuum tubes, is not only

New design "Zero Spindle" announced by N. A. Woodworth Co., Detroit, Mich., which is said to eliminate conventional bearing errors and guarantee near zero eccentricity. Used in combination with Woodworth "Push-Type" arbors, diaphragm chucks, and "Tork-Lok" collet arbors, this equipment achieves higher efficiency as an inspection tool. Its design incorporates a cast bearing block which permits the addition of a small base and tray top for indicator mount assemblies. The journal-adjustment feature has been changed to a single screw running parallel with the spindle. A larger wheel and knob assure ease of operation. Concentricity is guaranteed to 0.0001-inch true indicator reading. "Specials" are available for closer concentricity requirements.

Circle 616 on Readers' Service Card



## What's a "special size" in production bearings?

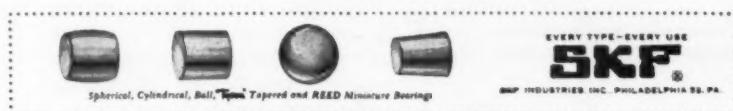
SKF makes so many standard sizes, there's practically no such thing as a "special size" of bearing. They range from tiny instrument bearings right up to four-row tapered roller bearings—and account for almost every possible bore size in-between.

Take SKF's standard cylindrical roller bearing, for example. It's promptly available in 154 sizes of single- and double-row types

—for shaft diameters ranging from 1" to 9.5". Every size, in both types, offers high radial capacity in relation to its size and operates at highest speeds because of its very low friction.

So, before you specify a "special size" bearing, call the nearest SKF sales office first. The odds are better than 1,000 to 1 that there's already a standard SKF bearing of exactly the size you need.

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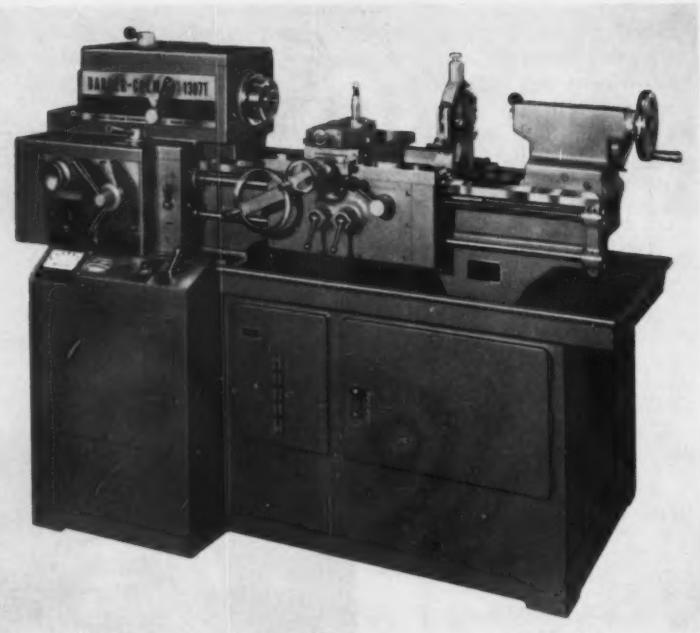
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**These companies are members  
of the Malleable Castings Council**

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Precision toolroom lathe introduced by Barber-Colman Co.

**Versatile Precision  
Toolroom Lathe**

High-capacity and timesaving controls have been combined in a precision toolroom lathe introduced by the Barber-Colman Co., Rockford, Ill. In its 10-inch class, this Model 1307T offers wide work ranges and many new features developed to assure high-quality precision work. Features designed for quick production of few-of-a-kind pieces, and to assure extremely accurate machining of complex work, include: specially selected Class ABEC-7 superprecision spindle bearings, ground-from-the-solid actuating screws throughout, antifriction bearings on all rotating shafts, normalized Meehanite castings throughout, hardened and ground headstock gears, splined shaft connections, hardened and ground ways under the tailstock and carriage, and direct-reading microdials.

Infinitely variable speeds to 3000 rpm in belt drive can be changed under load, without taking time to stop, start, or shift gears. A 5-hp motor powers a silicon-rectifier drive which not only is sensitive enough for precision tool and gage making, but also is rugged enough for production toolroom service.

Extra-large capacities include the 13-inch swing over ways, 24-inch center distance, 2 3/4-inch compound-rest travel, 1 1/2-inch spindle bore, and a D1-4 Cam Lock spindle nose. The lathe has sixty-six quick-change feed and thread-cutting changes in each of two ranges. A straight gear drive provides feeds from 0.002 to 0.120 inch per work revolution. Belt-driven feeds are exactly half of the gear feeds, from 0.001 to 0.060 inch per work revolution. On special work, transposing gears can produce feed rates as fine as 0.0002 inch. The machine can cut practically any number of threads with one, two, three, four, six, and nine starts.

Circle 593 on Readers' Service Card

**Magnedyne and Introdyne  
Hardness Testers**

Advance Industries, Inc., Cambridge, Mass., has announced the development of hardness testers which afford what is claimed to be the ultimate in accuracy and portability and which embody an entirely new loading principle. These testers provide Rockwell hardness readings for all standard and special scales and use loading and penetrators in accordance

(Continued on page 221)



Liquid flow through a cross section of a Malleable differential carrier.

## For Performance-Tested Dependability... Use **Malleable**

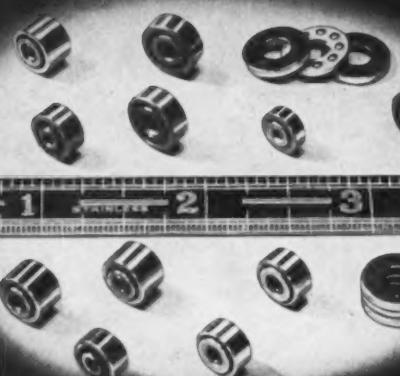
Molten metal flows evenly into all parts of the mold, then solidifies into pre-shaped parts with uniformly dependable properties throughout. Malleable iron castings will stand up under extremes of tension, impact, torsion, shear, fatigue, wear, heat, cold, and corrosion. They also offer maximum economy, are easy to work, and are versatile enough for parts ranging from a few ounces to hundreds of pounds.

The more manufacturers know about Malleable castings, the more they use Malleable to improve quality and increase profits. Get the full story on Malleable... Contact any of the progressive companies that display this symbol —

MEMBER



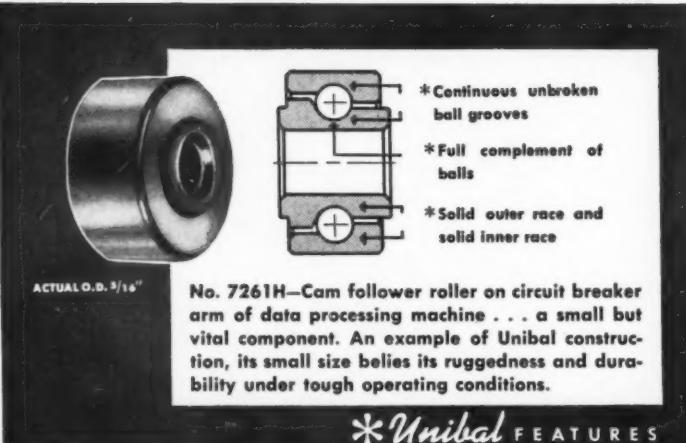
For details on Malleable's uniformity and reliability contact any company listed on the opposite page, or Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.



# LOW COST NICE MINIATURE BEARINGS

**NICE LOW COST MINIATURE BEARINGS** are unground bearings made to the highest quality standards and are designed to fill a growing need for inexpensive miniatures. They incorporate refinements of tolerance and finish which permit their successful use in many applications heretofore requiring costly precision miniature bearings.

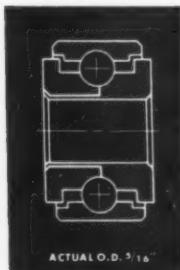
Many NICE miniature bearings incorporate the revolutionary new Unibal construction. Unique Unibal design and patented manufacturing methods produce bearings of exceptional strength, durability and smoothness of operation.



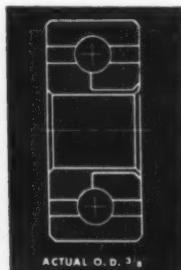
No. 7261H—Cam follower roller on circuit breaker arm of data processing machine . . . a small but vital component. An example of Unibal construction, its small size belies its ruggedness and durability under tough operating conditions.

\**Unibal* FEATURES

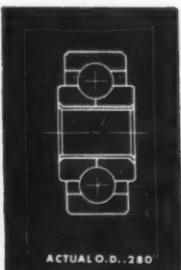
No. 6035-1 — Rear support bearing for print wheel carriage on electronic potentiometer.



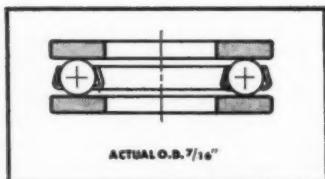
No. 6034-1 — Idler clutch bearing on 8 mm motion picture projector.



No. 6713 — Gear support bearing in parking meter mechanism.



No. 6172 — Tuning condenser thrust bearing on electronic communication equipment.



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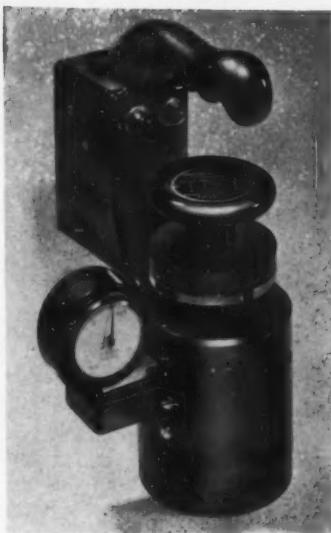


Fig. 1. Magnedyne hardness tester

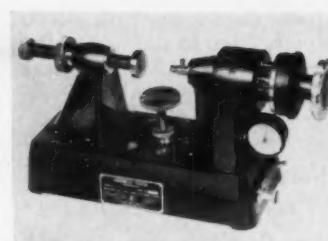


Fig. 2. Introdyne hardness tester

lifting of the material to be tested.

The Introdyne H-1 is the first of a series of nonmagnetic models employing the new loading principle. Inasmuch as no weights, levers, or pulleys are used, this device requires no leveling and can be moved from place to place with no special installation. Although it is designed essentially as a bench unit, the H-1 weighs only 21 pounds, and can be conveniently used for testing right at the job site. All testers are certified to be accurate to plus or minus one point of Rockwell hardness.

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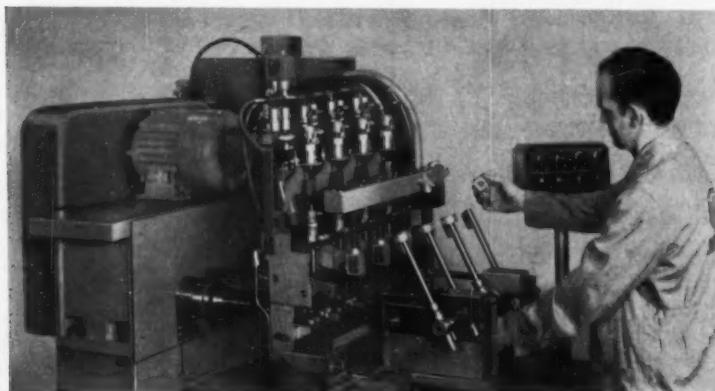
with both the ASME and ASTM specifications.

There are two models: the Magnedyne (Fig. 1), which attaches electromagnetically to the material to be tested, and the Introdyne H-1 (Fig. 2), which is a horizontal unit. The loading mechanisms of both units utilize a beryllium-copper spring; thus eliminating all weights, levers, and knife edges and providing permanent calibration.

Standard equipment with the Magnedyne is an adapter shoe which permits the unit to be attached to curved surfaces from 2-inch radius to infinity (flat surface). The unit weighs but 23 pounds, and is completely portable. It is particularly useful in testing large pieces because it eliminates the necessity of moving or

#### Precision Boring Machine for Aluminum Die-Cast Valve-Rocker Shaft Bearings

A standard single-end precision boring machine has been built by the Ex-Cell-O Corporation, Detroit, Mich., for rough- and finish-boring aluminum die-cast valve-rocker shaft bearings, four at a time, in a total cycle of only sixteen seconds. The parts processed on this machine are manually loaded and radially located on a ram type loader, which is subsequently moved downward and



Ex-Cell-O precision boring machine equipped to process valve-rocker shaft bearings



"The herring-bone gears in the drive unit of our 6-stand, 10-inch mill that rolls our high speed tool steels became noisy. Inspection showed definite signs of flaking of gears. This was in 1939. It was then we started to use LUBRIPLATE in them and we have not encountered any flaking trouble since."

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forward to feed the parts into their machining positions. The automatic cycle is initiated by the final movement of the loading mechanism. Automatic toggle clamps swing downward while a set of overhead pneumatic hammers tap the parts to ensure accurate seating on location pads.

The table rapid-traverses to the left where both rough and finish boring is performed. Unloading is exceptionally rapid. As the clamps are released, air pressure forces the work-pieces from their posi-

tions and onto a conveyor which transports them to the rear of the machine. At this time air jets clear chips from location pads.

Circle 595 on Readers' Service Card

### Osborn Power Brushes for Precision Finishing

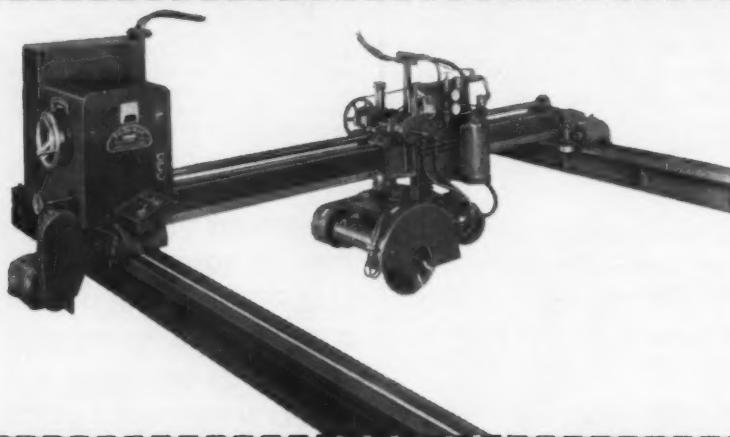
Brushes developed for precision power finishing announced by the Osborn Mfg. Co., Cleveland, Ohio. These brushes are available in wheel diameters of from 4 to 12 inches. They consist of straight-



wire cutting points, encapsulated in a plastic bond to precisely control the finishing action. The "Master Blend" tools of this line represent a totally new concept in power brushes, differing both in action and results from conventional brushes. Because of the precisely controlled cutting action, peening or rolling of metal edges is kept to an absolute minimum and, in many cases, is entirely eliminated. Edge blends can be held to extremely close tolerances, making possible production finishing of pump gears and similar products requiring an 0.005-inch edge blend. Operating techniques are the same as with any precision industrial tool. Careful setup and pressure control are necessary to achieve maximum results from the new tools. Originally designed for use on Osborn metal-finishing machines, they are highly effective on all other types of polishing lathes, rotary indexing machines, in-line machines, and other equipment. The new line is already in service in a number of automotive and appliance manufacturing plants for surface-finishing operations on parts such as brake discs, and removal of aluminum and zinc flash from die-cast parts. The power brushes are expected to see extensive service in a wide range of operations, including removing burrs and blending edges of ferrous and nonferrous fine-pitch gears, removing flash from plastic parts, producing close-tolerance edge blends on clad metal products, and burr removal and edge blending of powdered metal parts. In many instances, the new tools will replace finishing operations which formerly required the use of deburring compounds.

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## ECONOMY SAW CUTS SHEET STOCK WITH 4-WAY ACTION



Accurate Squares up to 10 ft. Wide  
Any Length — Cuts Metal or Plastics

The new Ty-Sa-Man Economy "111-CX" produces accurate square rectangles up to any length, and up to 10 feet wide, from stock up to two inches thick. Motor and arbor travel on a transverse rail, which moves along two side rails. This four-way movement, in combination with the 90 degree swivel head, permits trimming all four sides of a plate without moving it. Handling time is reduced to a minimum.

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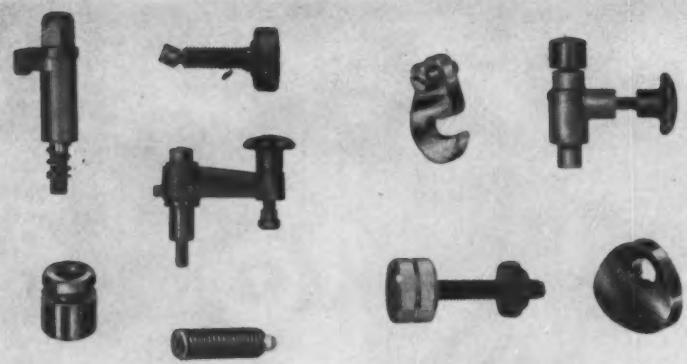


The complete range of sizes and types of air circuitry products is stocked and cataloged by your Schrader distributor. Consult the yellow pages or write Schrader.



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QUALITY AIR CONTROL PRODUCTS



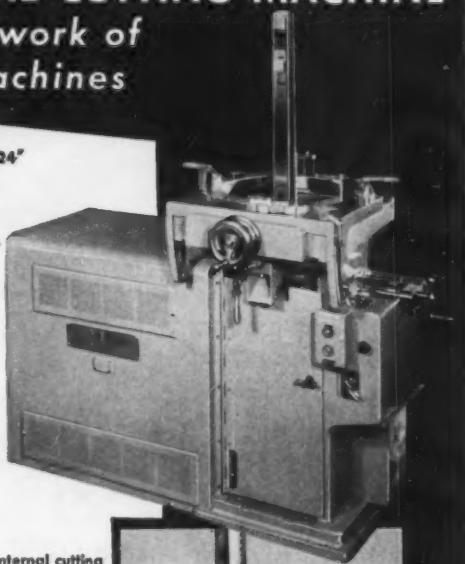
### Additions to Line of Jig and Fixture Components

The Universal Engineering Co., Frankenmuth, Mich., has recently added several hundred items to its growing stock of jig and fixture components and clamp assemblies, including the typical examples here illustrated. This brings to more than a thousand the varied toolroom accessories manufactured in regular and stainless steel by this company. The new clamp assemblies, fixture details, spring plungers, torque screws, and chuck jaw blanks now being produced are designed to complement Universal's standard line of drill bushings; collet chucks; floating, boring, and oil-coolant chucks; boring-bars; and Kwik-Switch production tools.

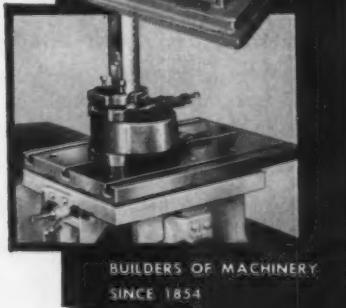
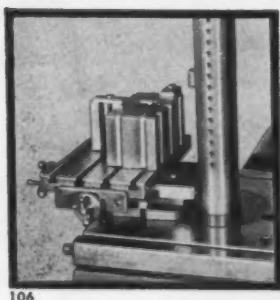
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## AMAZING NEW HYDRAULIC **M&M** KEYSEATER AND VERTICAL CUTTING MACHINE does the work of many machines

In addition to a keyseater that cuts internal keyways up to 3" wide x 24" long, the new hydraulic M & M is a handy tool room machine and can be easily adapted to special production jobs other than keyways. A wide variety of internal or external cuts, serrations, grooves and teeth can be rapidly made on this machine. With a combination tilting table and index table (shown on machine at right) straight or tapered bores and accurately spaced multiple keyways or splines may be cut of any degree of the circle. Send us prints of your cutting problems.



Right: Set-up for internal cutting  
Below: Set-up for external cutting



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106

### Numerical Control with Visual Display of Tool or Work-Piece Position

Modumatic linear display system brought out by the Norden Division, United Aircraft Corporation, Stamford, Conn. This system features full-range electronic origin selection and absolute display of actual cutting-tool or work-piece position. Designated Series 100, it is specially designed for adaptation to existing as well as new machines. It automatically performs calculations for rotary and linear positioning, utilizing a unique position feedback transducer, electronic circuitry, and a visual display to indicate the actual position of the tool or work-piece. The actual position is displayed in straight decimal form by illuminated numbers that are readable at a distance of 20 feet. The display unit may be located on the machine or some remote position. The full-range electronic origin-selection feature permits any desired offset to be quickly and easily dialed.

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## DEPENDABLE... predictable response to heat treatment every time



Send for Bulletin 102—  
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Hints."

The full uniformity within each bar of Desegregated FM die steel and the consistent uniformity from lot to lot simplifies the heat treatment of your die components. Predictable hardnesses are readily attainable . . . distortion and size change are minimized . . . danger of cracking is lessened!

In free machining FM die steels, full uniformity is achieved through Latrobe's unique Desegregated process of manufacture. This process guarantees an even distribution of carbide particles, free machining alloy sulphides and other alloying elements . . . factors leading to improved machinability, greater toughness and improved wear resistance in addition to the optimum heat-treating characteristics.

Latrobe's 12% chromium FM die steels are available through district steel service centers near you. Grades include: Olympic FM (Type D-2) for long-run applications; GSN FM (Type D-3) non-deforming die steel; Cobalt Chrome FM (Type D-5) for extra resistance to galling and pickup.

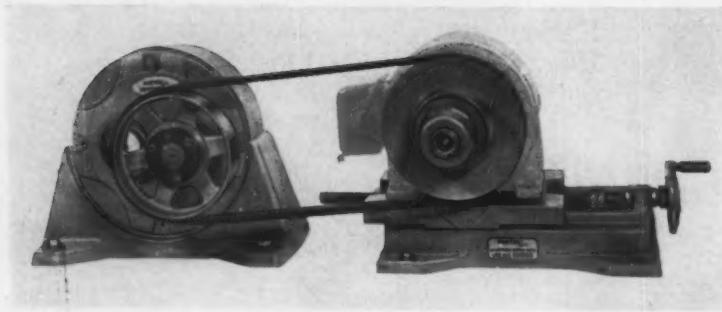
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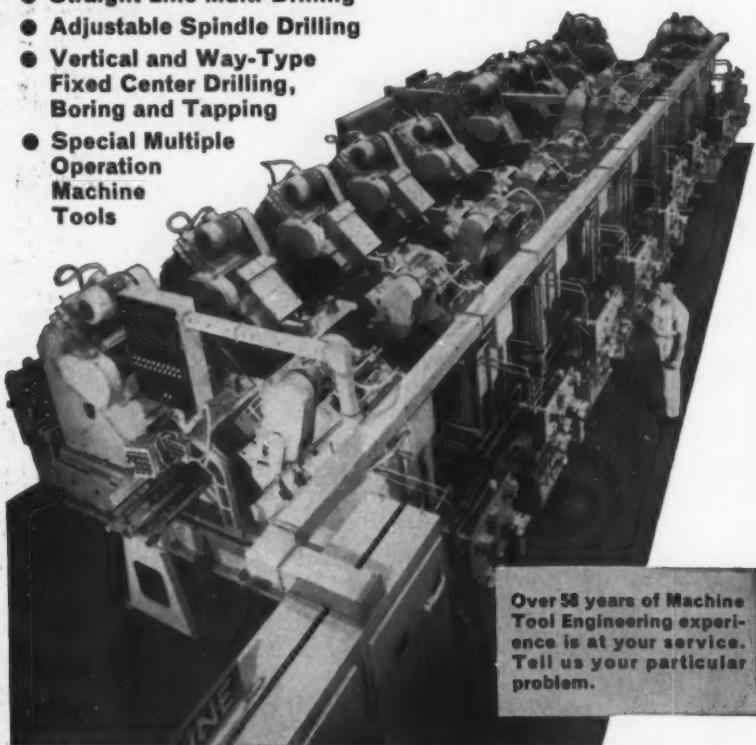


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- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools



Over 58 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.

112

Twenty-Station, Ten-Unit Transfer Machine for boring, counter-boring, chamfering and valve clearance operations on V-8 automotive engine blocks. (Shown above)



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## Variable-Speed Drive

A variable-speed reduction drive announced by Boston Gear Works, Quincy, Mass., is made up of stock components and is designed for use with motors of 3/4 to 3 hp. The drive combines the company's standard variable-speed pulley, belt, and adjustable motor base with a standard shaft-mounted or horizontal base-mounted Optimount helical-gearered Reductor. Driven-shaft speeds are provided in various 3-to-1 infinitely variable ranges between 431 and 24 rpm.

Circle 599 on Readers' Service Card

## Rotary Indexing Table

"Milichex" rotary indexing table, Model M2X-900, for fractions of angles announced by Michigan Tool Co., Detroit, Mich. A double-table arrangement allows settings to be made to quarter degrees with an accuracy of 1/4 second of arc. Useful for either inspection or machining, the rotary indexing table eliminates gage-blocks and permits an unskilled operator to quickly set and reproduce any angle in increments of 15 minutes. Extreme accuracy and simple operation is claimed for the double-table construction. The lower table is a standard Milichex Model MX-3600 360-tooth rotary type which indexes in full degrees. The upper table is a special 96-tooth rotary design with each tooth equal to 3 degrees 45 minutes. Any angle in increments of 15 minutes is reproducible by simply adding or subtracting one of several multiples of 3 degrees 45 minutes (on the upper table) to the full degree setting of the lower table. For ex-



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All information about hardness testing in easy-to-read text with many illustrations. Just write "Send Book" on your letterhead. Description and prices for Clark Hardness Tester and free Hardness Conversion Chart also available on request.



Missile-Age Accuracy

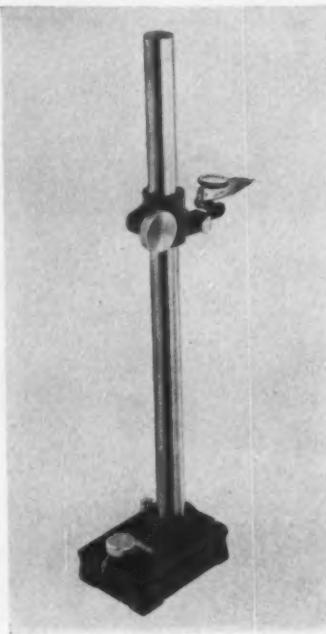
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ample, to set the table to 23 degrees 45 minutes, the lower table is indexed to 20 and the upper table to letter D corresponding to 3 degrees 45 minutes. Only four letter indexes—A (−3 degrees 45 minutes), B (−7 degrees 30 minutes), C (0), and D (3 degrees 45 minutes)—are required on the upper table to duplicate any angle to 15-minute increments. To facilitate rapid setup on repetitive fractional-angle settings, a simple, tabulated chart can be made up so that the operator can quickly index to the required angle by merely setting the lower table to proper degree reading and upper table to either A, B, C or D. The table top is 12 inches in diameter and parallel with the base within 0.000050 inch. The top is furnished with a large number of drilled and tapped, radially dispersed holes for easy attachment of work-pieces or fixtures.

Circle 600 on Readers' Service Card

#### Federal Height Stand for Gage Heads and Dial Indicators

General-purpose height stand, Model 2300, announced by Federal Products Corporation, Providence, R. I. This stand has sufficient accuracy and stability to be used with electronic gage heads, as well as dial test indicators, for

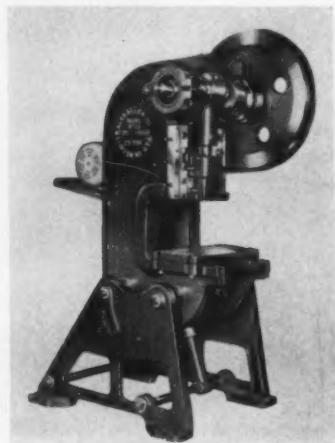


measurements at heights up to 18 inches. Its contoured base measures 3 by 4 3/8 inches, has a three-point support to eliminate any chance of rocking, and is designed so that any heat transferred from the hand in no way affects the column support or its adjustment. Wide-range fine adjustment (up to 0.030 inch) is located on the base, rather than on the arm as in most height stands, so that it can be operated without influencing the position of the gage head or indicator. A split clamp with large knob secures the arm without need for auxiliary locking devices. The 7/32-inch-diameter mounting post takes a regular universal clamp and is removable for substitution of scribe marker or other transfer device, if desired.

Circle 601 on Readers' Service Card

#### Allen Heavy-Duty Punch Press

Allen Model BT-25, 25-ton power punch press announced by Alva Allen Industries, Clinton, Mo., as their newest and largest punch press. This press has a shut-height die space of 7 3/8 inches with the ram down, adjustment up, standard stroke, with bolster plate and 8-inch throat (distance from center of ram to frame). The press is designed and manufactured along the same lines as preceding models. The new machine can be easily set up for any standard punch-press operation, such as blanking, forming, shearing, riveting, drawing, cutting, punching, crimping, etc. It is equipped with the manufacturer's reliable single-



# EXTRA RIGIDITY of Chicago-Latrobe Drill pays off at Tool Show demonstration!



3" hole through 3" plate took just 52 seconds. Note perfectly formed chips that indicate continuous, vibration-free cutting even while operating at .100" rate of feed. Demonstration took place at Machine Tool Show.

At the Chicago Tool Show the Carlton Machine Tool Company introduced its new 6 ft. Radial Drilling Machine. In one of the most dramatic drilling operations ever performed, they drilled a 3" diameter hole in a hot rolled steel plate 3" thick in just 52 seconds, operating at 45 RPM with a feed of .100" per revolution.

Chicago-Latrobe was asked to

produce a drill for this demonstration. C-L engineers recommended the regular Type 110 High Speed Taper Shank Drill—*special in length only*.

Unbelievable strength is required for a twist drill to do a job like this, and C-L's exclusive method of producing large diameter drills made the Carlton demonstration possible. Chicago-Latrobe drills are man-

ufactured from grooved stock—rolled to exact specifications; twisted to the correct helix; with the flutes and lands precision milled. This method gets the most from the steel—added torsional strength, maximum rigidity, *minimum disturbance to its molecular structure*. Specify Chicago-Latrobe for your tough jobs. Chicago-Latrobe products are sold by industrial distributors.

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THRU 3" OF STEEL IN  
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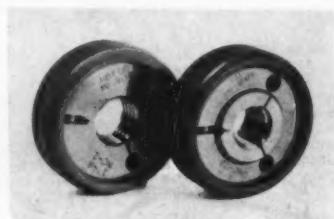
pin, knife type clutch and can be easily changed from repeat (continuous) to nonrepeat (single-stroke) action. Adjustable V-type ram gibs are 14 inches long. Crankshaft diameter at main bearings is 2 1/2 inches, with extra-long bronze main bearings of 5 inches. The die bed is 12 by 21 inches, with a 5 by 8-inch opening in the bed. A mechanical tilting mechanism allows the press to be inclined up to 30 degrees. The heavy 400-pound, 28-inch diameter, 4-inch face flywheel assures ample power. The standard stroke is 2 1/2 inches with other strokes of 1/4 to 4 inches available in 1/4-inch graduations at extra charge. It requires a 2-hp motor.

Circle 602 on Readers' Service Card

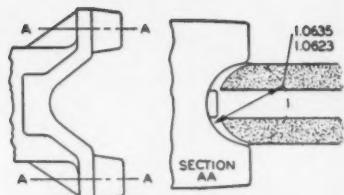
#### Greenfield Guards for Thread Ring Gages

Greenfield gage guards announced by the Geometric Tool Co., division of Greenfield Tap & Die Corporation, New Haven, Conn. The illustration shows the gage guards applied to "Go" and "Not Go" ring thread gages for their protection. The cost of the gage guards is negligible compared to the cost of maintenance and/or repair of unprotected gages. Aside from wear, shock is said to be the greatest single cause of ring-gage damage. The flexible gage guards cushion the shock of accidental dropping or other rough contact which might change the gage setting and destroy its accuracy. The raised ridge of the guard protects the surface of the gage from scratches and dirt accumulation. Change in gage size due to heat absorption in handling is also eliminated by the insulating quality of the guard. Green for "Go" and red for "Not Go" gages saves time and possible error with instant color identification of the gages.

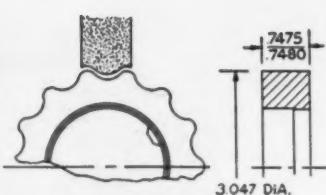
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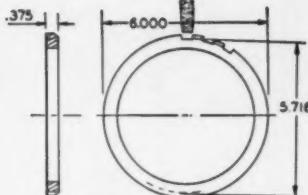
MACHINERY, December, 1960



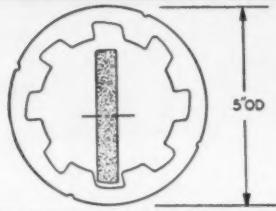
Job: Grind 2 half-rounds from rough  
Part: Universal Joint  
Output: 400/hr, floor to floor  
Material: Pearl. Mall. Iron  
Pcs/load: 10



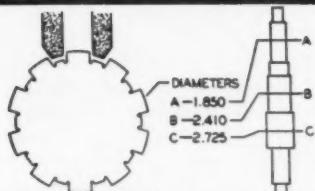
Job: Contour grind 14 lobes  
Part: Pump rotor  
Output: 88/hr, floor to floor  
Material: Steel 200 Brinell  
Pcs/load: 12



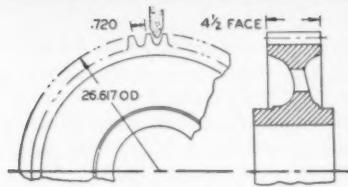
Job: Grind 24 teeth from solid  
Part: Splined spacers  
Output: 18/hr  
Material: Steel  
Pcs/load: 9



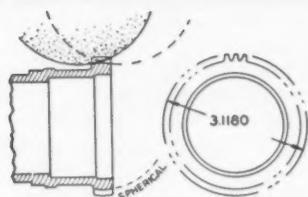
Job: Contour grind internal cams  
Part: Roller clutch cam  
Output: 60/hr  
Material: Case hardened steel  
Pcs/load: 2



Job: Straddle grind 3 sets of 10-splines (parallel sides)  
Part: Transmission mainshaft  
Output: 2.7/hr/spline set  
Material: Steel 61-64 Rc  
Pcs/load: 1



Job: Grind 94 teeth (.017" per side)  
Part: Railroad gear  
Output: 1.1/hr, floor to floor  
Material: Steel 60 Rc  
Pcs/load: 1

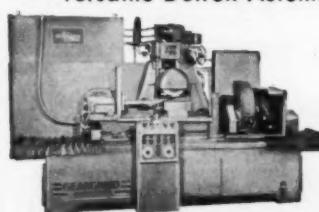


Job: Spherical grind 48 teeth  
Part: Spherical gear coupling  
Output: 2.3/hr  
Material: Carburized 60 Rc  
Pcs/load: 1

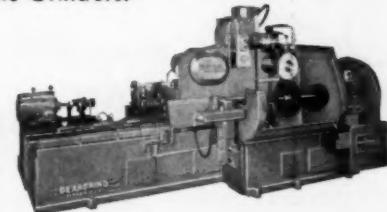
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**to cut costs, improve  
accuracy on external  
and internal contours**

Here are some examples. You can do all these jobs—involute, cycloidal, spherical, etc.—at either high production or job-shop rates with top accuracy on highly versatile Detroit Automatic Grinders.



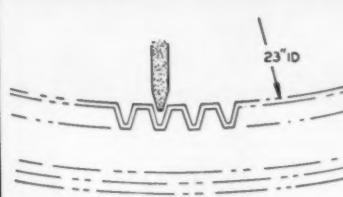
"Detroit" automatic contour grinder for up to 20" PD.



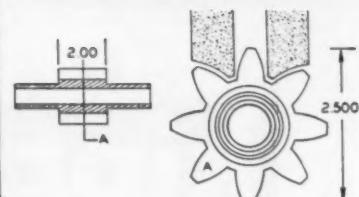
"Detroit" automatic contour grinder for up to 36" external and 30" internal.

**GEAR GRINDING MACHINES DIVISION  
MICHIGAN TOOL COMPANY**

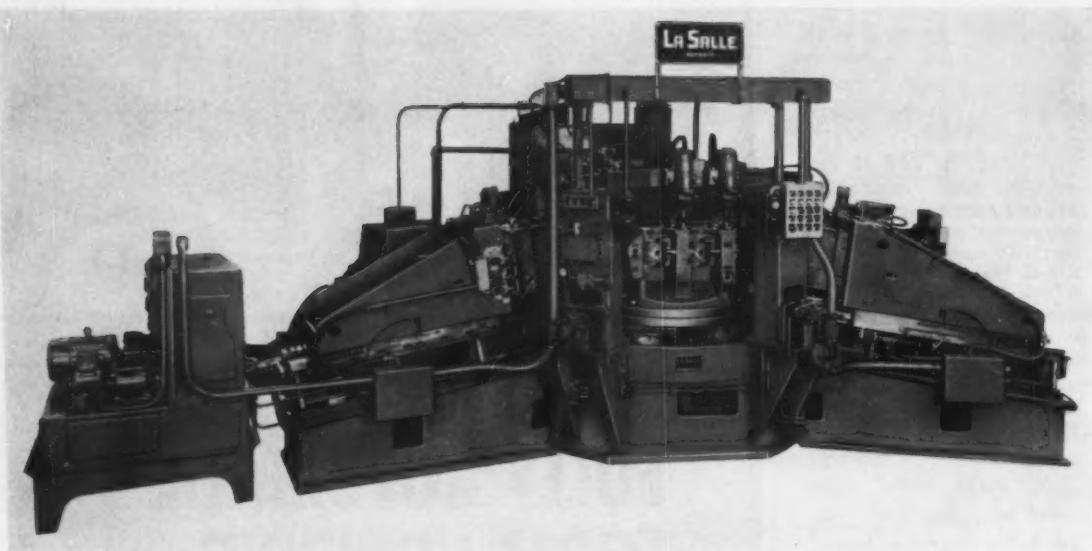
7171 E. McNICHOLS ROAD • DETROIT 12, MICHIGAN



Job: Internal grind 157 teeth  
Part: Aircraft reduction gear  
Output: 1.2/hr  
Material: Case hardened  
Pcs/load: 1



Job: Straddle grind 8 teeth  
Part: After-burner pump gear  
Output: 11/hr, floor to floor  
Material: Nitrided steel 15N-90  
Pcs/load: 1



Production machine of building-block construction developed by LaSalle Machine Tools, Inc.

### Production Machine Tool of Standardized Building-Block Construction

LaSalle Machine Tool, Inc., Warren, Mich., is pioneering a completely new type of production machine tool. Referred to as a Building Block production ma-

chine, it can be built either as a single- or multiple-station machine capable of performing drilling, boring, reaming, tapping, and related operations. The eight stand-

ardized basic components which form the nucleus of these Building Block machine tools are: the main base, wing base, wing-base adapter (dial type), way type feed unit, quill type feed unit, horizontal angular adapter, angular column, and vertical column.

The standardization applies to the mounting and attaching surfaces of these components, the bolting patterns, the bolt sizes, the location method, and the uniform work-loading height. These standardized, basic Building Blocks permit the maximum flexibility required to expedite changes in product design, and greatly reduce the cost of such changes. The machines are designed to avoid premature obsolescence, and reduce pattern, engineering, and machining costs.

One of the first of the new Building Block production machines is shown in the accompanying illustration. It is a five-station dial type machine designed to process steering knuckles. Two parts at one time are manually loaded (clamped) and unloaded (unclamped) at the first station. The ball-stud holes are rough-taper-reamed in the second station, and the inside surface of the ball-stud bosses are milled in the third station. Mounting holes are spot-faced and chamfered in the

## HOW TO DESIGN EXCESS WEAR Out of MACHINE TOOLS WITH MADISON-KIPP Fresh Oil Lubricators

Machine Tools, Compressors and special machines of all kinds have been kept in top condition for 20 or 30 years or more when equipped with one of 6 models of Madison-Kipp Lubricators.

Fresh Oil Lubrication is automatic, closely measured, constantly fed new oil under pressure for each friction surface to which it is applied.



The Model OL—one of the 6 Models of Madison-Kipp Lubricators.

# kipp

MADISON-KIPP CORPORATION  
203 WAUBESA STREET • MADISON 10, WISCONSIN

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

WILLIAMS WRENCHES measure longer than Industry Average for extra leverage.

Both ends permit nut rotation in 30°.

Uniform head thickness carefully proportioned for optimum fit on hex and square nuts and bolt heads of regular, heavy or finished series, plus all other series nuts and bolts.

Depth of jaw opening designed for full bearing on all nut sizes and series.

Slim, narrow jaws combine maximum strength with greatest clearance.

Modified, rectangular handle design offers maximum strength and comfort.

Satin finish for safe, firm grip. No dirt catching or uncomfortable ornamentation.

Height of box wall correctly proportioned for all nut sizes and series.

Box head with 12 point opening, offset 15° from handle for obstruction clearance.



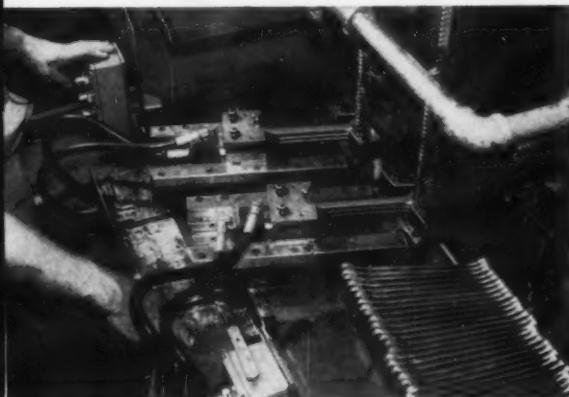
Wall thicknesses designed for maximum strength with greatest clearance.

## You need both... QUALITY DESIGN QUALITY MANUFACTURE



### IT'S A PUSH BUTTON WORLD AT WILLIAMS

This three station transfer machine drills, broaches and chamfers box openings to close Williams' tolerances.



Open-end heads are broached to extremely close tolerances on this two station vertical ram machine.

*You get the most for your money when you buy WILLIAMS!*

**You get the most for your money when you buy any tool, wrench or stock forging from Williams' broad line of 4530 stock catalog items.**

**THE BROADEST LINE OF ITS KIND**

MR. WRENCH SAYS: "Get the Facts... get TOOLFACTS... new 24 page booklet on how to select, use and care for Quality Wrenches."

J. H. WILLIAMS & CO.

Division of United-Greenfield Corporation  
409 VULCAN STREET, BUFFALO 7, N. Y.

Mr. Wrench: Please send me your new  
 TOOLFACTS Booklet  ILLUSTRATED CATALOG No. 304

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FIRM \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

WILLIAMS



## SLOCOMB MICROMETERS

Stock Mikes,  
 Special Mikes



Specialization is part of the answer for Slocomb makes only micrometers and no other type of measuring gage, tool or instrument. This concentration on producing the widest possible variety of fine, precision micrometers has resulted in a line of over 900 different models!

Whatever your micrometer needs, chances are Slocomb can supply it . . . fast. From 1" conventional micrometer calipers to 60" Rigitube models . . . airfoil, tube, screw thread, sheet metal types . . . just to mention a few.



### SPEEDMIKE

Another Slocomb first! Digitally read, the new Speedmike achieves the ultimate in measuring speed and accuracy. Yes . . . you can have "direct reading" on other Slocomb micrometers.



## SLOCOMB

Stocked and Sold  
 By Your Industrial Distributor

J. T. Slocomb Co.  
 101 Matson Hill Rd., So. Glastonbury, Connecticut  
 Circle this page number on card

fourth station, and the ball-stud holes are finish-taper-reamed in the fifth station.

The production rate at 100 per cent efficiency is 232 parts per hour, and at 80 per cent efficiency, 186 parts per hour.

Circle 604 on Readers' Service Card

### "Bi-Tip" Drills with Throw-Away Tips

A new type of oil-hole drill, known as the Bi-Tip, has been announced by the Detroit Reamer & Tool Co., Birmingham, Mich. This drill features two-flute replaceable tips of solid carbide, high-speed steel, or steel with tungsten-carbide tip. After repeated sharpenings have expended the usable cutting-tip area, a new tip can be brazed to the undamaged body at a fraction of the original drill cost. Each tip is designed to provide complete interlocking and positive locating with the body of the drill.

The single-flute body has margin and land for high durability. The design of the single-flute body assures maximum chip clearance that is especially effective in deep-hole drilling of aluminum. Regardless of drill diameter (5/16 to 1 inch), there are two coolant holes for even and constant flow of coolant to the cutting lips. Two hundred pounds of pressure per

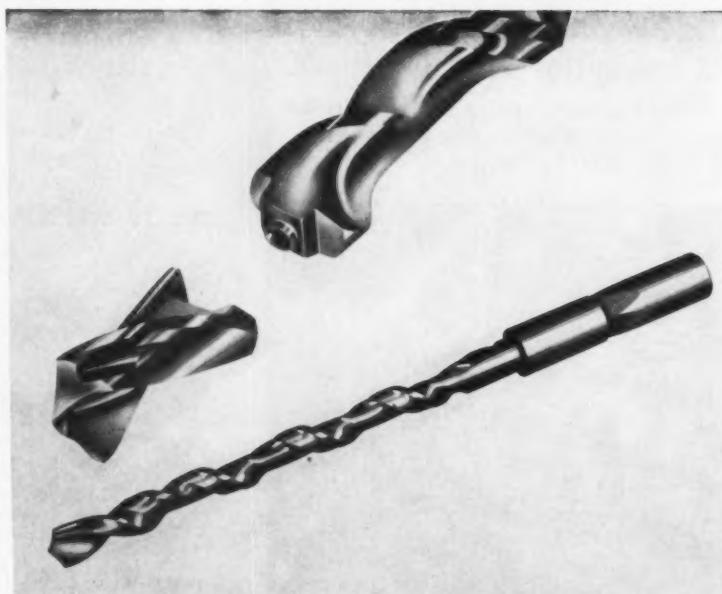
square inch is more than sufficient. There is no need for special oil—just an ordinary soluble solution being satisfactory.

The drills permit drilling the entire depth of a hole with one pass. Cutting lips are said to remain cool. When specified, Bi-Tip drills will be supplied with "Tru-Kut" radius points, an exclusive development of the manufacturer. The Tru-Kut principle assures self-centering, free cutting, a high degree of accuracy, and a fine finish. The Bi-Tip drill is especially designed for aluminum but has also proved very effective for drilling in cast iron, bronze, and steel.

Circle 605 on Readers' Service Card

### "Hi-Helix" Tap for "Space Age" Metals

Tap of new line introduced by the Morse Twist Drill & Machine Co., New Bedford, Mass., for precision tapping of the newly developed difficult-to-machine materials. Known as Hi-Helix, the line features efficient removal of the chips and eliminates broken taps



Oil-hole drill with throw-away tip announced by Detroit Reamer & Tool Co.



You can do more with

**DELTA**

## NEW 'Long Bed' 10" Metal Lathe offers capacity up to 36"



Delta 10" Metal Lathe with  
Long Bed (36" between centers) available in bench  
or cabinet models with a  
complete line of accessories.

Now Delta introduces the "big brother" to the famous 10" Metal Lathe—with a big 36" capacity between centers and an exclusive combination of features that make it the big value in its class.

This new model fills the need for a low-cost, precision lathe capable of handling heavy duty work in production, in plant maintenance shops and in tool rooms. In addition to extra capacity, it provides: variable speed drive with choice of speeds from 50 to 1500 rpm, quick change gear box allowing selection of 54 feed rates or thread pitches, and  $\frac{3}{4}$ " collet capacity—largest available in any comparable lathe.

See your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages) about the many other extra performance features you get. For FREE catalog describing the complete line of Delta Metal Lathes, write: Rockwell Manufacturing Company, Delta Power Tool Division, 614<sup>M</sup> N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

**DELTA INDUSTRIAL TOOLS**

another fine product by

**ROCKWELL**

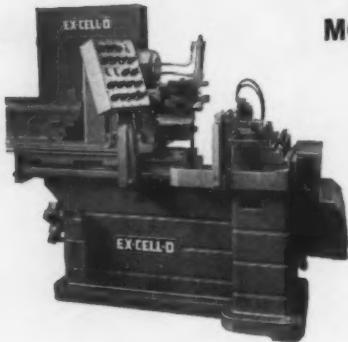


# NEW!

## Ex-Cell-O Boring Machines

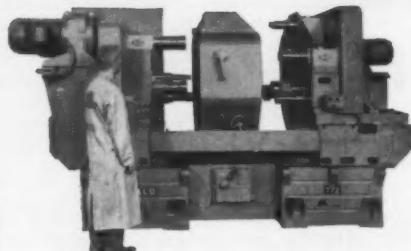
### A Size, a Type, a Model to Fit Every Production Need!

From subminiature bearing races to giant transmission housings—whatever the work, there's a standard Ex-Cell-O engineered and built to do the job with the performance of the costliest custom equipment!



#### MODEL 308 PRECISION CAM BORING MACHINES

For production parts requiring close-tolerance contouring, boring, turning, facing and grooving (singly or in combination), Ex-Cell-O Models 308 and 312 (for larger work-pieces) feature the precise repeatability only direct cam control of table and cross slide can offer. Fast, easy cam-changing makes these models ideal for short runs at high production rates.



#### MODEL 772 HORIZONTAL BORING MACHINES

Accuracy, heavy cuts and good finishes on large parts are the high-production characteristics of the Ex-Cell-O Model 772. This dual bridged machine, the largest standard horizontal boring machine in the Ex-Cell-O line, is designed for maximum cycle efficiency and features rugged construction, infinite feeds, and thrust load compensation.

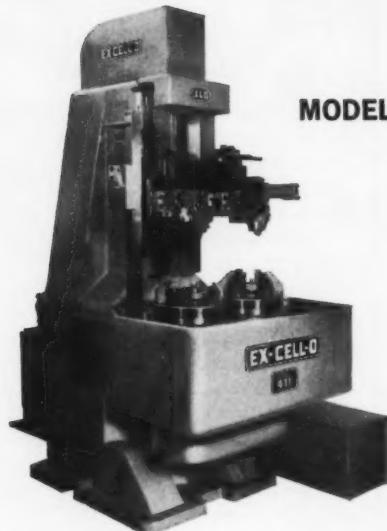
A single-end companion machine, Model 771, is also available.



#### MODEL 712 MULTIPLE SPINDLE PRECISION BORING MACHINE

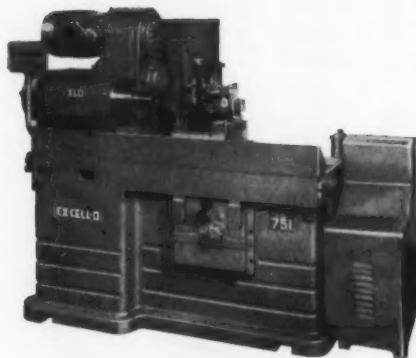
Full machine utilization is made possible by the easily-changed multiple-spindle plates featured on Ex-Cell-O's Models 712 and single-end 711. Built-in cross slide permits indexing between bores or sets of bores, and the fully automatic cycle assures maximum efficiency on multiple hole precision boring operations.

# for Production Efficiency



## MODEL 411 VERTICAL PRECISION BORING MACHINE

Versatility is the production feature of the new Model 411 Ex-Cell-O Vertical Precision Boring Machine. Easy tool changing and safe, easy, loading of heavy parts also contribute to the on-the-job efficiency of this single-column precision machine. Seven different arrangements of components are possible for maximum versatility.



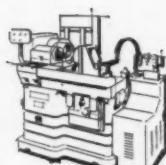
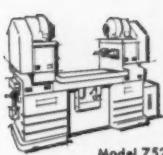
## MODELS 731, 732, 751, 752 HORIZONTAL PRECISION BORING MACHINES

Maximum dimensional stability under all kinds of operating conditions, and accurate repeatability on boring, turning, facing, counterboring, chamfering, recessing and trepanning operations are the forte of this new line of Ex-Cell-O Standard Precision Boring Machines.

Some of their features: Temperature controlled and insulated mounting of hydraulic control panels . . . extremely rigid bases and tables . . . hydraulic and coolant systems externally mounted . . . new Ex-Cell-O standard and tapered roller bearing spindles . . . manual or automatic operation . . . flexibility to permit use in automated production lines.

Contact your Ex-Cell-O Representative or write direct for details.

60-67



### EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

### Machinery Division

**EX-CELL-O**  
CORPORATION  
DETROIT 32, MICHIGAN

# BRAD FOOTE

# gears

...FOR A WORLD AT WORK

## SPIRAL BEVEL GEARS

for precision mechanisms and heavy duty power transmission



above • BRAD FOOTE 60° Spiral Bevel Gear Generator cutting the teeth in gear for heavy duty oil drilling rig

left • Power testing the same gear with mating pinion in BRAD FOOTE Gleason testing machine. Note the localized central-toe bearing produced to facilitate ease of assembly.

BRAD FOOTE offers the finest cutting and testing equipment available for the production of precision spiral bevel gears in the widest range of capacities.

These include such diversified drives as: spiral, zero, right angle, obtuse or acute angle. They may be in sizes from 1" to 60" diameter, 10 DP to 1 DP and from 1/2" face to 10" face.

For precision mechanisms or heavy duty power transmission, BRAD FOOTE

builds your gears from blanks to finished product...fills all your requirements from one source.

### ORDER FROM BRAD FOOTE

Your order for BRAD FOOTE Gears will be processed by an experienced organization of gear specialists and produced on the most extensive and versatile facilities available. Maximum performance and your complete satisfaction are assured because no one shares our responsibility.



#### OTHER BRAD FOOTE SPECIAL EQUIPMENT

INCLUDES: High Precision Rack Broaching  
Machine with capacity up to 1 DP; 154"  
Precision Gear Shaper; 72" Diameter  
Shaving Machine



## BRAD FOOTE GEAR WORKS, INC.

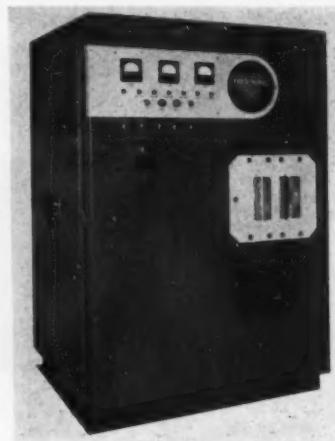
1313A South Cicero Avenue • Cicero 50, Illinois • Bishop 2-1070 • Olympic 2-7700  
Subsidiary • PITTSBURGH GEAR COMPANY, Neville Island • Pittsburgh 25, Pa., Phone: SPaulding 1-4600

caused by clogged flutes. The taps are said to cut smooth, accurate threads to the most exacting tolerances even in deep holes interrupted by slots or keyways. They are available in all regular sizes from No. 3 through 1/2 inch.

Circle 607 on Readers' Service Card

### Ther-Monic Generator

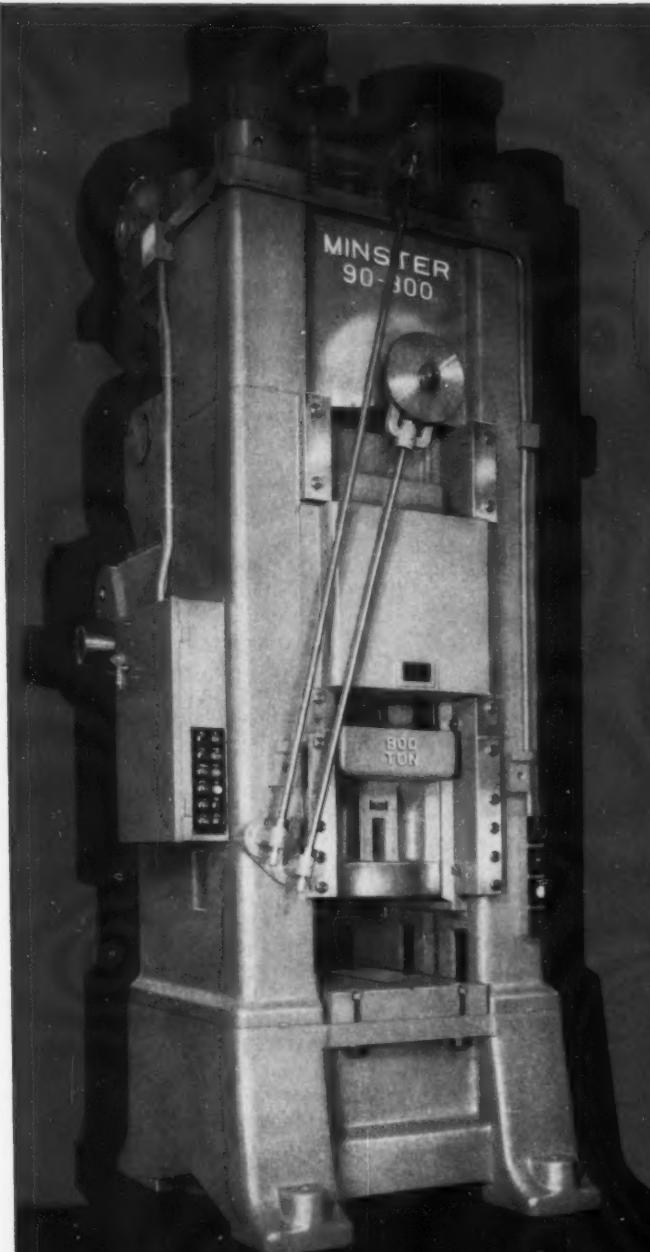
Ther-Monic 30-KW generator capable of producing power at both high and low frequencies introduced by the Induction Heating Corporation, Brooklyn, N. Y. By merely flicking the selector switch the unit can be operated at low frequencies of from 250 to 450 kc, and from 1 to 7 mc. All controls are built in and are operated externally. Coils and fixtures are mounted in front of the generator and require no additional cabinets. External grid adjustments are possible on both frequencies. The generator can be adapted to such diverse applications as soldering, brazing, annealing, and hardening. A variable output transformer for low-frequency operations, and a



completely adjustable tank for those jobs requiring high-frequency heating, are housed in the completely dust-tight cabinet. The generator is also equipped with a saturable reactor for controlled output, and can be constructed with Thyron-controlled output. Heat exchangers for water and cabinet cooling are all built in. A complete set of meters for operating the generator for various types of applications, as well as

These Outstanding  
Features Make  
**MINSTER®**  
**KNUCKLE JOINT PRESSES**  
**More Productive**

- The Precision Built into the Press  
Gives You Greater Parts Accuracy—  
Longer Press Life
- More Single Stroke Operations  
per Minute
- Higher Speeds for  
Greater Velocity of Impact
- Positive Continuous Lubrication  
Provides Greater Precision, Reduced  
Wear, Less Maintenance
- Massive Frame and Tie-Rod  
Construction Withstands the  
Tremendous Forces of Knuckle Joint  
Press Work



COINING



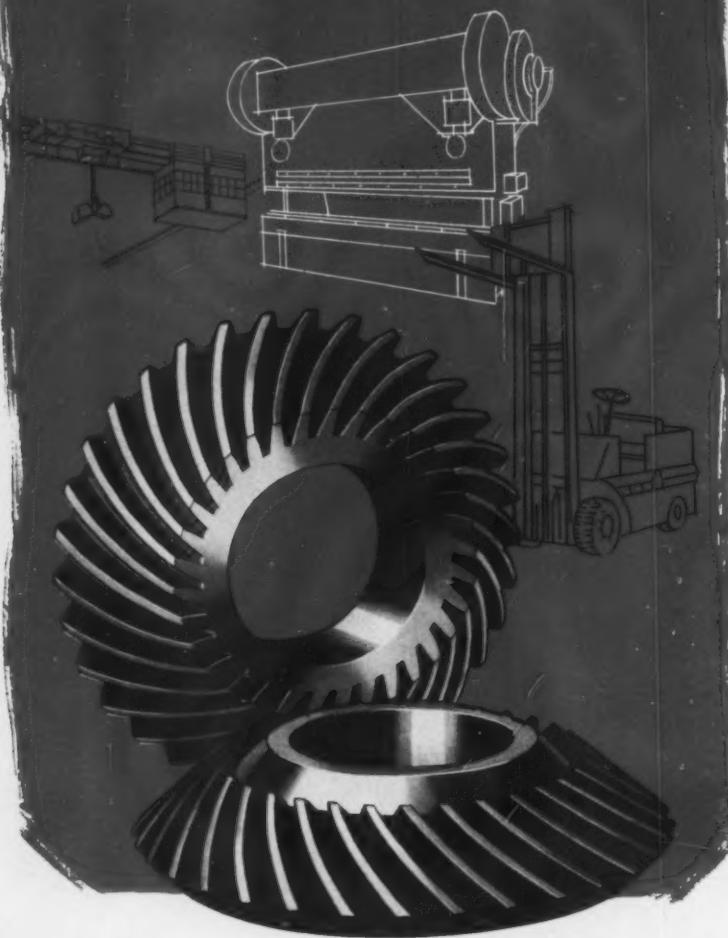
EMBOSSING



**THE MINSTER MACHINE COMPANY**  
MINSTER, OHIO

# Whatever the product...

Only "quality" gearing  
meets specific design  
needs exactly!



Cincinnati gears are GUARANTEED to meet specifications exactly. Our skilled craftsmen operate the most up-to-date precision machines for gear cutting, finishing, and inspection. And our unique production control assures delivery as promised.

Send for NEW 32-page Technical Brochure



## THE CINCINNATI GEAR CO.

Wooster Pike and Mariemont Ave. Cincinnati 27, Ohio  
Custom Gear Makers Since 1907

GEARS, good gears only



trouble lights to designate proper operation of the equipment, is set into the front of the housing.

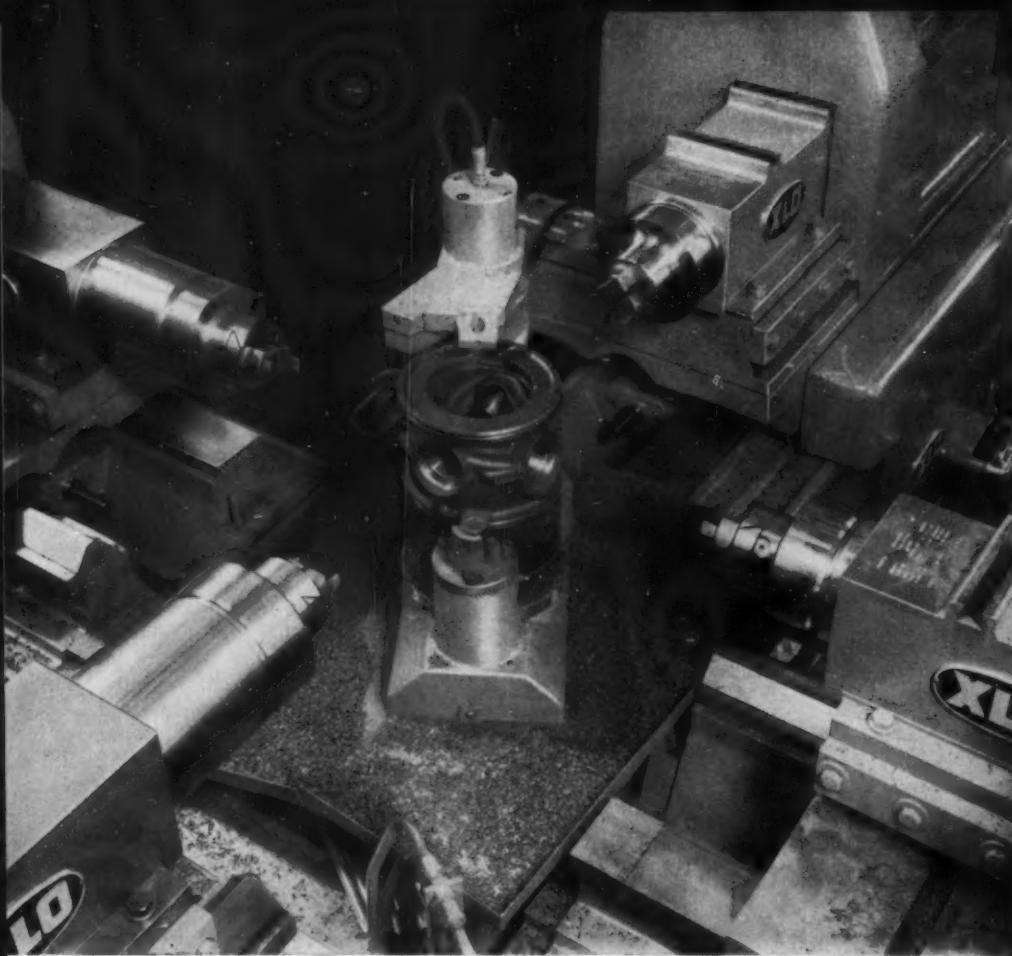
Circle 609 on Readers' Service Card

### Parker-Hannifin Check Valves

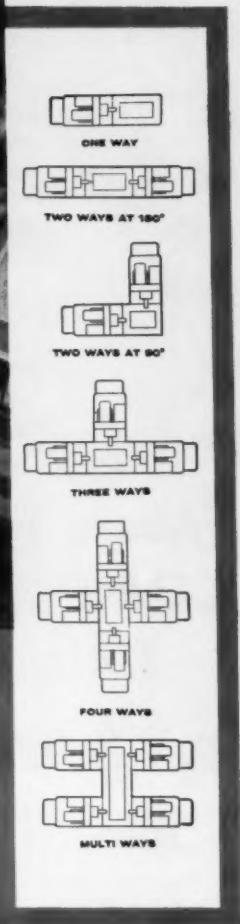
One of a new line of machinery check valves—featuring rugged construction, long service life, easy serviceability, extremely tight sealing on reverse flow, and low-pressure drop—announced by the Parker-Hannifin Corporation, Cleveland, Ohio. Angle, in-line, and gasket-mounting type check valves are included in this new line. The angle valves are standard for operating pressure of 3000 psi. They are available also for 5000 psi, and range in capacity from 3 to 65 gpm (gallons per minute) in internal-pipe-thread port types from 1/4- through 1 1/2-inch sizes, and in straight-thread port types (tube outside-diameter sizes) from 3/8 through 1 1/2 inches. The gasket-mounting valves—for maximum operating pressure of 5000 psi—are in two capacities: for 20 or 50 gpm. Mounting subplates with 3/4-inch pipe or 1-inch tube outside-diameter straight-thread porting are available for the 20-gpm valve. Subplates for the larger capacity valve have 1 1/4-inch pipe or 1 1/2-inch tube outside-diameter straight-thread ports. The in-line checks—for 3000-psi pressure—range from 3 to 50 gpm, and are offered with pipe-thread ports or with JIC cone ends for direct connection of 37-degree tubes using Triple-lok tube-fittings.

Circle 610 on Readers' Service Card





TYPICAL  
"BUILDING BLOCK"  
ARRANGEMENT



## 4-Way Production Savings with Ex-Cell-O Way Machines

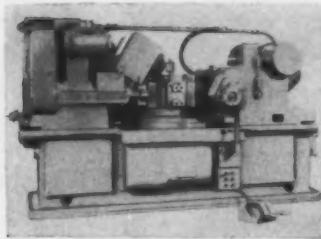
**1 LOWER COST** Each Ex-Cell-O "Building Block" Way Machine Unit has standard base, table slide and complete, inbuilt hydraulic system. You can specify only the standard spindles or accessories that meet your present needs. **2 INCREASED FLEXIBILITY** One Way-type unit gives you a basic, versatile precision boring machine; as operations become more complex, simply add one or more Way units to a common end section to multiply production or machining functions. **3 MORE VERSATILITY** Ex-Cell-O Way Machines permit precision boring, turning, facing or grooving, chamfering or counterboring—with or without automatic cycles, work indexing or clamping. **4 GREATER CAPACITY** Using simple fixtures, you can rough or finish-machine larger, heavier work than possible on most standard boring machines.

Ask your Ex-Cell-O Representative about savings with Way-type Machines, or write direct for details.

Typical setup shows four units positioned at 90° for simultaneous rough boring, counterboring and trepanning. Beds, tables, center section, hydraulic systems, controls and Ex-Cell-O Precision Spindles are standard components. Units can be rearranged at any time.

60-29





## More Pieces COMPLETELY finished in less time on GOSS & De LEEUW AUTOMATIC CHUCKERS

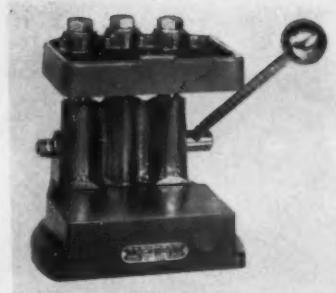
This machine . . . already acknowledged and accepted as a metal-working achievement, and the only standard one of its kind . . . winds up a day's operation with all parts assigned to it completely finished and with no secondary operations necessary. When fully loaded, a complete piece is finished at each index cycle. High productivity is attained with simple tooling.

The "1-2-3" exclusive Goss & De Leeuw feature provides for finish machining three ends of a part simultaneously or in sequence. All operations are performed in a single set-up, and complete finishing done in much shorter time than by conventional methods.

Send for illustrated literature which fully describes this recent Goss & De Leeuw development in chucks. Submit samples of your work for time and cost estimates.



**GOSS and DE LEEUW**  
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



**"Cone-Lok" Jig**

Three post "Cone-Lok" jigs added to the Style No. 1 series made by the N. A. Woodworth Co., Detroit, Mich. Two models are now available with 15-square-inch work areas: one with a shut height of 3 inches and another with a shut height of 5 inches. Model numbers are FC-1533 and FC-1535, respectively. With the addition of the Style No. 1 series, jigs can be supplied from stock in work-area sizes from 2 to 48 square inches.

Circle 611 on Readers' Service Card

### Fafnir Pillow Block

Low-cost pillow-block unit which incorporates high-quality bearings announced by the Fafnir Bearing Co., New Britain, Conn. Sturdy, economical pressed-steel housings provide a precision bearing-to-housing fit and a true self-aligning bearing that effectively bridges the gap between light-duty pressed-metal housings and heavy-duty cast-iron housings. Known as the PBS, this new unit accommodates shaft sizes between 1/2 and 1 7/16 inches. It is suitable for most pillow-block bearing applications where moderate speeds, moderate radial loads, and relatively light thrust loads are encountered, as in fans, idler shafts, conveyors, pump shafts, and other lightly loaded power shafts.

Circle 612 on Readers' Service Card





## They make piston pins faster for less money with National Seamless Mechanical Tubing

It takes plenty of machine time to drill and machine the holes in 6,500,000 piston pins a year. That's what one major auto company\* had to do . . . *until* the switch to USS National Seamless Steel Mechanical Tubing. By eliminating the need to drill holes in the bar stock, the company got rid of six chuckers formerly used for drilling, saved time as well as the power they consumed and the space they occupied. □ USS National Seamless Tubing has dimensional accuracy. It has no hard or soft spots. It's made by people who know more about seamless tubing than any other manufacturer in the world. You can choose from a complete range of sizes and steel grades. Find out how USS National Seamless Mechanical Tubing can be most effectively applied to your designs. Contact your nearest National Tube Distributor soon.

USS and National are registered trademarks

\*Name supplied on request



This mark tells you a product is made of modern, dependable Steel.

**National Tube  
Division of  
United States Steel**



Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors  
United States Steel Supply Division  
United States Steel Export Company, New York

# News OF THE INDUSTRY

## California

Appointment of HASKEL ENGINEERING & SUPPLY CO., 1236 S. Central Ave., Glendale 4, Calif., as a distributor of Hannifin industrial air and hydraulic cylinders and Parker industrial hose and hose fittings is announced by PARKER-HANNIFIN CORPORATION, Cleveland, Ohio. Co-operating with the distributing firm will be D. G. HENDERSON, regional manager, Parker-Hannifin sales office, 5827 W. Century Blvd., Los Angeles 45, and C. Q. HAGERTY, district manager of distributor sales in southern California.

The appointment of D. L. JOHNSON as manager of systems and procedures has been announced by CONVAIR (San Diego, Calif.), a division of GENERAL DYNAMICS CORPORATION. During ten years' service with Convair, Mr. Johnson has been an industrial engineering supervisor, chief of manufacturing planning and methods, and chief of systems and procedures.

IRVINE F. WILLIAMSON has been appointed superintendent of NORTON Co.'s Santa Clara, Calif., plant. He will assume his new duties in January, after special training at the main plant in Worcester, Mass.

JOHN D. MARGESON has been appointed southern manager for AMERICAN DRILL BUSHING CO., Los Angeles, Calif.

## Illinois and Missouri

CLEARING DIVISION of U. S. INDUSTRIES, INC., Chicago, Ill., has made the following sales appointments: GEORGE HERRICK is general sales manager—automotive sales. He will be in charge of all Detroit, Mich., sales and other specific automotive accounts outside of the Detroit area. PHILIP DELMER has been made general sales manager—domestic sales, excluding automotive sales. LOUIS TUGLAS is new manager of shear sales, operating with dealers in the promotion of the Scrap Shear line of presses. DAVE BONNAR has been named manager of dealer press

sales. He will handle all sales and functions pertaining to Clearing's press-dealer organization. DEAN COCHRAN is now manager—hydraulic sales, and will work with both direct and dealer organizations. STEPHEN MILLER has been made manager—machine tool sales, dealing with the direct dealer sales organization in the lathe division.

CLEARING DIVISION of U. S. INDUSTRIES, INC., Chicago, Ill., has an-

nounced the appointment of E. P. CUNNINGHAM as senior vice-president—director of international operations. Mr. Cunningham had previously been general sales manager and vice-president of domestic sales. He has been associated with Clearing since 1934. E. J. BAUMRUCKER was appointed vice-president—domestic sales. He had previously been manager of the Detroit, Mich., area and most recently, general sales manager.

Roy W. BOYD has been appointed by GISHOLT MACHINE CO., Madison, Wis., as a direct sales representative for the Chicago, Ill., territory.

LAWRENCE W. WIGHTMAN has been appointed assistant to the vice-president in charge of operations of EMERSON ELECTRIC MFG. CO., St. Louis, Mo. He will be responsible for manufacturing research and development for Emerson's commercial division.

## Michigan and Wisconsin

A regrouping of plants in the power train group has been announced by CHRYSLER CORPORATION, Detroit, Mich. A. L. GOSTOW will be general manager—forge and foundry plants, including Chrysler foundry, Detroit forge, and Winfield foundry in the Detroit area; American foundry, Indianapolis, Ind.; Chrysler casting, Kokomo, Ind., and New Castle, Ind., forge plant. A. W. HARTIG has been named general manager—engine, axle, and transmission plants, including Lynch Road gear and axle, Mound Road engine, and Trenton engine in the Detroit area; Kokomo, Ind., transmission; and the new process gear plants, Syracuse, N. Y. FRED OSANN is to be general manager—parts and equipment manufacturing plants, including Detroit universal, Highland Park manufacturing, and McGraw glass plants in the Detroit area; Indianapolis, Ind., electrical; and New Castle, Ind., machining. Under the regrouping, R. A. McCARROLL has been assigned to staff responsibilities within the power train group. J. R. CYPHER becomes plant manager, Trenton engine, and W. L.



E. P. Cunningham, senior vice-president—director of international operations, Clearing Division of U. S. Industries, Inc.

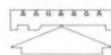


E. J. Baumrucker, vice-president—domestic sales, Clearing Division of U. S. Industries, Inc.

## When you think of **PRECISION**

For life time precision Lucas provides

airlift to saddle

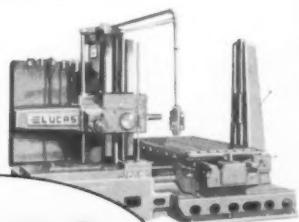


and table.



These elements are supported on a thin film of lubricated compressed air during traverse. This separation of metal from metal virtually eliminates wear. During machining cycles the saddle and table are automatically clamped down tight to provide absolute rigidity for even the heaviest cuts. Unclamping is automatic, too. These are two aspects of Lucas design which contribute to the precision of these machines. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of Precision . . .

**think of . . .**



**LUCAS**  
PRECISION





## When you think of **RELIABILITY**

Lucas automatic power positioning  
automatically repeats   
automatically repeats   
automatically repeats   
to  $\pm .0001 \dots$

A simple, completely reliable system of dial indicators, end measures, and electrical controls automatically disengages rapid traverse, engages the fixed, constant-rate power feed and precision stops the unit at predetermined settings. Automatic power positioning assures the highest order of repetitive accuracy with an absolute minimum of operator attention.

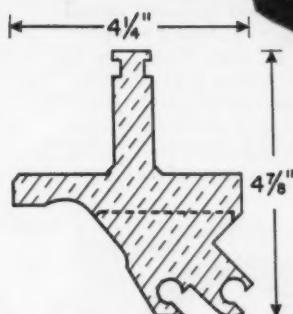
A new catalog describes our complete line of horizontal boring, drilling and milling machines. Write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of Reliability . . .

**think of . . .**



**LUCAS**  
PRECISION

# AGAIN-



DOTTED LINE SHOWS where two copper extrusions were brazed together to make original part. When you consider the intricate shape and the weight of the part (a  $3\frac{1}{4}$ " section measuring  $4\frac{1}{4}$ " x  $4\frac{7}{8}$ ", weighing 8 lbs. 7 ozs.), you can readily understand why it was at first thought impractical to make it into a single extrusion.



## Revere helps "fit the metal to the job"

**AND ONE COPPER EXTRUSION REPLACES TWO, SAVING TIME AND MONEY  
WITH CONSIDERABLE INCREASE IN LIFE OF PART**

The Revere Copper Extrusion shown above was originally two extrusions brazed together. And, since it is quite an intricate shape, and weighty, it was at first thought impractical to make as a single extrusion, but the possibility was believed to be worth investigating.

Through close collaboration between the manufacturer's engineering department and the Revere Methods and Production Departments, it was found possible to combine these two sections into a single extrusion. Work was started, dies were made and test runs conducted. The tooling (for hot extrusion was followed by cold drawing) posed special problems. It had to be both rugged and precise in order to produce this monster to the manufacturer's exacting specifications. Finally, a sample extrusion was delivered to the customer for testing and found to be right in every way.

Not only does this new, single extrusion eliminate a great deal of machining but obviates the necessity of purchasing two separate extrusions and brazing them together. This means

substantial savings in dollars and time involved, plus a longer-lasting part, because the heat required to join the two pieces originally used, tended to soften the built-up unit, thus shortening its useful life.

So, before you give up on what at first may seem an insoluble problem, why not call in Revere's Technical Advisory Service? It's entirely possible they can help you "fit the metal to the job" with a resultant saving in the production of a superior product.



**REVERE**  
COPPER AND BRASS INCORPORATED

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, N. Y.

*Sales Offices in Principal Cities: Mill-Rose, N. Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and San Jose, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N. Y.; Neodesha, Ark.; Ft. Calhoun, Neb.*  
**Distributors Everywhere.**

**MIRON** has been named as plant manager at Kokomo. **A. O. MALONEY** was named plant manager at Highland Park, replacing **T. R. PATRICK**, who will assume new responsibilities as quality-control manager of the power train group. **H. R. BENTLEY** has been named plant manager at Lynch Road.

**HENRY C. DAUM** has been appointed vice-president in charge of sales by **BUHR MACHINE TOOL CO.**,



Henry C. Daum, newly appointed vice-president in charge of sales, Buhr Machine Tool Co.

Ann Arbor, Mich. Mr. Daum was formerly manager in the manufacturing engineering office, manufacturing staff, **FORD MOTOR CO.**

**CLEVELAND WORM & GEAR** and **FARVAL DIVISIONS** of **EATON MFG. CO.**, Cleveland, Ohio, announced the appointment of the **J. R. DUNLOP CO.** as sales representative in the Detroit, Mich., area for the complete line of products of the two divisions. **J. R. Dunlop Co.**, located at 18609 W. Seven Mile Road in Detroit, was formed recently by **JACK DUNLOP**. Associated with him will be **T. A. SHANNON**, formerly a field engineer with the Farval Division in the Detroit area.

**E. HOWARD PERKINS** has announced his retirement as president of **BROOKS & PERKINS, INC.**, Detroit, Mich., and the election of **EDWARD L. LADD** to succeed him. Mr. Perkins, a cofounder of the firm in 1943, remains as chairman of the board.

**JAMES JOHNSTON** has been appointed factory sales representative of **WHITMAN & BARNES**, a division of

**UNITED-GREENFIELD CORPORATION**, Plymouth, Mich. Mr. Johnston will work with W&B distributors in servicing customers in the Pittsburgh, Pa., area, western Maryland, southeast Ohio, and the state of West Virginia.

**CINCINNATI MILLING MACHINE CO.**, Cincinnati, Ohio, has taken possession of the adjacent real estate of the former **CINCINNATI BICKFORD DIVISION OF GIDDINGS & LEWIS MACHINE TOOL CO.**, Fond du Lac, Wis. The manufacture of Giddings & Lewis' Bickford line of drilling products has been moved to newly enlarged quarters in Kaukauna, Wis. With the move went key personnel and the newest machines from the Cincinnati plant to augment the facilities already in Kaukauna.

### New York, New Jersey, and Connecticut

**NEW JERSEY ZINC CO.**, New York City, announced the promotions of **R. WILLIAM ROSENQUEST** to manager-metal sales, eastern division, and **CHARLES H. PRINCE** to manager-technical service, metal division. Mr. Rosenquest has been a sales representative for the company's metal and alloys for twelve years. Mr. Prince has been in technical service work for the past six years, serving the company's customers in the metalworking fields.

**OAKITE PRODUCTS, INC.**, New York City, has announced the appointment of two new technical service representatives to the company's field organization: **ROBERT D. CASEY** and **MICHAEL D. JULIANA**. Mr. Casey will represent the company in Arizona, with headquarters in Phoenix. Mr. Juliania has been appointed to the Charleston, W. Va., territory.

**FRANK J. NUNLIST** has been appointed to the new position of vice-president-operations of **WORTHINGTON CORPORATION**, Harrison, N. J. In his new position Mr. Nunlist, formerly a group vice-president of Worthington, will be responsible for the activities of all the company's sixteen domestic operating divisions in ten states and regional engineering and service activities.

**JARVIS CORPORATION**, Middletown, Conn., has announced the promotion of three company executives to corporate vice-presidents. They are:

**GEORGE CARVALHO**, general manager, machine tool & attachments subsidiary, Middletown, Conn.; **JOSEPH BRESCHIA**, general manager, tap subsidiary, North Attleboro, Mass.; and **PAUL HANSCOME**, general manager, carbide-tool subsidiary, Lynn, Mass. All three will continue to devote the major portion of their efforts to the respective subsidiaries in addition to their new duties as vice-presidents.

**NORMA-HOFFMANN BEARINGS CORPORATION**, Stamford, Conn., has announced the following appointments: **WILLIAM B. CLARK** has been named manager of manufacturing engineering; **FRANK H. RAE**, chief process engineer; and **DAVID ALBERT**, superintendent of inspection and quality control. Mr. Clark, previously superintendent of inspection and quality control, will be responsible for su-



William B. Clark, manager-manufacturing engineering, Norma-Hoffmann Bearings Corporation



Frank H. Rae, new chief process engineer for Norma-Hoffmann Bearings Corporation

# IT'S NEW IT'S VERSATILE IT'S AMERICAN

...and it's designed from the ground up to give you faster, more economical, more automatic production.

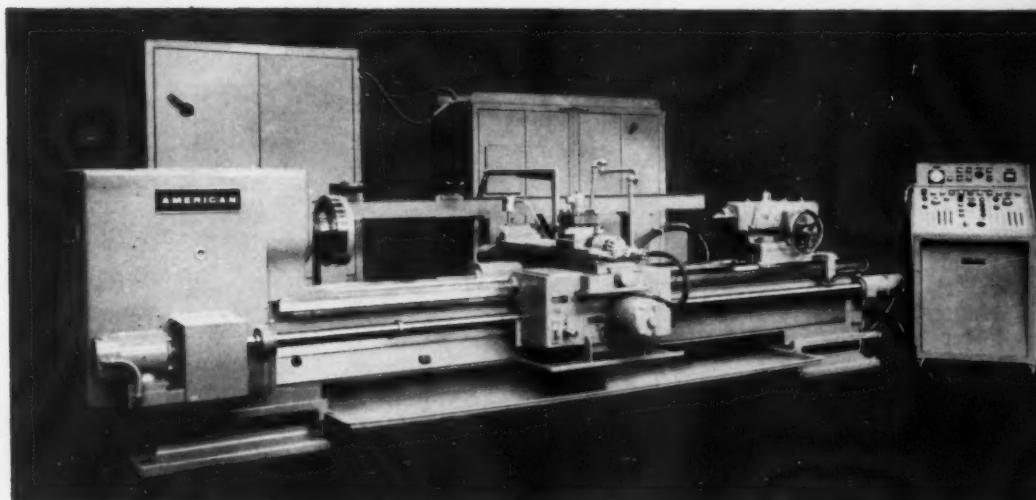
Here's a production athlete with both muscle and brains. A punched tape keeps it humming.

20 spindle speeds and 20 feed rates, tape selected. Spindle drive by a 50 H.P. constant H.P. variable speed reversing motor. Square turret is tape controlled. Lathe has hardened and ground cross and longitudinal Ball Screws. Tape preparation requires no computers. Simple to operate. Error free. Write for Bulletin 912-A.



## THE AMERICAN 2509 TAPE CONTROLLED LATHE

T U R N I N G • B O R I N G • F A C I N G



This and all other AMERICAN machine tools are available on "Toolease," our popular leasing plan. Send for Bulletin 801 for details.

COMPETE COMPETENTLY WITH

**AMERICAN**

LATHES • RADIAL DRILLS  
SPECIAL MACHINES



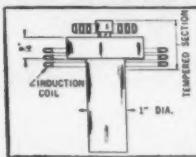
**The American Tool Works Company**  
Pearl Street at Eggleston Avenue • Cincinnati 2, Ohio

# Lepel

## HIGH FREQUENCY INDUCTION HEATING UNITS

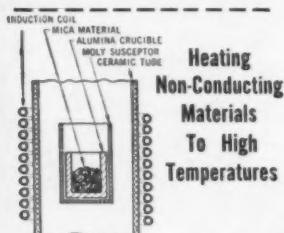
**Lepel induction heating equipment represents the most advanced thought in the field of electronics...the most practical and efficient source of heat developed for numerous industrial applications. You are invited to send samples of work with specifications. Our engineers will process and return the completed job with full data and recommendations without cost or obligations.**

### TYPICAL INDUCTION HEATING APPLICATIONS



#### Punch Heads Selectively Tempered

Diagram shows arrangement for selectively tempering heads of alloy steel punches. The use of a combination type solenoid and pancake induction coil reduces hardness from Rc 55/56 to Rc 41/44, improving resistance to brittle fracture at the head of the punch. In this case a heating cycle of 55 seconds provides uniform tempering. A multiple position fixture, processing 4 pieces at one time, speeds up production.



#### Heating Non-Conducting Materials To High Temperatures

Laboratory analyses frequently require heating of non-conducting materials to temperatures of 3,000 to 3,500° F. in vacuum or special atmosphere. This can be accomplished by induction heating with the aid of a metal susceptor. Diagram shows the fusion of mica samples in an alumina crucible, using molybdenum susceptor. A ceramic tube surrounding the susceptor isolates the work for fusion in a vacuum. The molybdenum susceptor is heated by induction, which in turn, heats the crucible by radiation.

#### WRITE FOR NEW LEPEL CATALOG

Electronic Tube Generators from 1 Kw to 100 Kw.  
Spark Gap Converters from 2 Kw to 30 Kw.

**Lepel** HIGH FREQUENCY  
LABORATORIES, INC.

55th ST. & 37th AVE., WOODSIDE 77, N.Y.

Circle this page number on card



David Albert, newly appointed superintendent of inspection and quality control, Norma-Hoffmann Bearings Corporation

perscription of all the company's manufacturing engineering activities. Mr. Rae, who will be responsible for development of new manufacturing techniques, joined Norma-Hoffmann in 1934. Mr. Albert, who will head the company's quality-control and inspection division, previously served as chief customer representative.

WILFRED THOMPSON has been made vice-president—sales for the BULLARD CO., Bridgeport, Conn. Mr.



Wilfred Thompson, vice-president—sales, Bullard Co.

Thompson was formerly district sales manager with headquarters in Detroit, Mich. In his new assignment, he will be responsible for the sales of the entire line of Bullard products.

SKINNER CHUCK CO., New Britain, Conn., has had its name changed to SKINNER PRECISION INDUSTRIES, INC.

The company's board of directors, in recommending the change, did not overlook the historical name of Skinner Chuck Co. This will be retained by the designation of the chuck division as SKINNER-HORTON CHUCK DIVISION. The name of the valve division will remain the same—SKINNER ELECTRIC VALVE DIVISION.

ROBERT C. MAIN has joined SPERRY PRODUCTS CO., a division of HOWE SOUND CO., Danbury, Conn., to assume the duties and responsibilities of manager of engineering, a newly created position.

### Ohio

CHARLES R. BENDER has been appointed executive secretary of the



Charles R. Bender, executive secretary of the National Tool, Die & Precision Machining Association

NATIONAL TOOL, DIE & PRECISION MACHINING ASSOCIATION, Cleveland, Ohio. Mr. Bender has been serving as assistant executive secretary of the association since 1953. He will be in charge of the association's office and operations.

CARPENTER STEEL CO., Reading, Pa., has opened a new mill-branch warehouse and specialty-steel service center in Cleveland, Ohio. The new center, located at 4901 W. 150 St., will have CHARLES H. HARTON, Carpenter's Cleveland district manager, as director of operations.

MARION DIVISION of EATON MFG. CO., Marion Ohio, has announced four promotions. ROBERT A. WIELAND, Jr., formerly assistant plant manager, has been named factory manager. Mr. Wieland held the positions of budget supervisor, assistant



Pat. No. 2355224

only **vega** offers you all these advantages

**order after order after order...** minimum size change and distortion... low temperature heat treating... uniform deep hardenability... freedom from scaling... good machinability... exceptional toughness with good hardness... no preheating in hardening.

From start to finish you enjoy exceptional simplicity and safety and predictable performance. Produced by the MEL-TROL® Process... Only Carpenter VEGA-FM assures such uniformity of benefits. Use this MATCHED SET of Air-Hardening Tool and Die Steels—VEGA-FM (Type A-6), No. 484-FM (Type A-2), and No. 610-FM (Type D-2)—for proper selection and consistently better results. Call your Carpenter SERVICE-CENTER for prompt delivery.

## Carpenter steel

you can do it **consistently** better with Carpenter Tool and Die Steels

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.

Alloy Tube Division, Union, N. J.

Webb Wire Division, New Brunswick, N. J.

Carpenter Steel of New England, Inc., Bridgeport, Conn.



chief industrial engineer, and chief industrial engineer in the axle division. CHARLES D. BARNES, formerly purchasing agent of the Marion Division, has been appointed divisional sales manager. ARTHUR J. ZAHN has been named personnel director, and STANLEY J. ROG has joined the Marion Division as an industrial engineer.

A. F. BOUCHER has been named assistant general sales manager by LINCOLN ELECTRIC CO., Cleveland, Ohio. He has been district manager in Lincoln's Milwaukee, Wis., and

Detroit, Mich., territories during eighteen of the past twenty-one years.

JAMES B. ANDERSEN has been made manager of Kendex tooling sales by KENNAMETAL INC., Latrobe, Pa. Mr. Andersen, who was formerly field supervisor in the Detroit, Mich., sales district, will have his headquarters in Willoughby, Ohio.

SHEFFIELD CORPORATION, a subsidiary of BENDIX CORPORATION, Dayton, Ohio, has named OSCAR AHLERS vice-president and general



Oscar Ahlers, newly appointed vice-president and general manager, Sheffield Corporation



Roy Heldenbrand, new vice-president of operations for Sheffield Corporation

manager. ROY HELDENBRAND, who was president and general manager of THREADWELL TAP & DIE CO., has been made vice-president of operations for Sheffield.

#### Pennsylvania and Florida

RITTER ENGINEERING CO., 1409 Sedgwick St., Pittsburgh 33, Pa., is announced as a franchised distributor for Hannifin power cylinders and air-control valves by PARKER-HANNIFIN CORPORATION, Cleveland, Ohio. WAYNE G. RITTER is head of the distributing firm, which will be extended technical cooperation by personnel in the Parker-Hannifin sales offices at 300 Mt. Lebanon Blvd., Pittsburgh 34, under regional management of W. E. ANDERSON.

EDWARD P. SANDBACH has been appointed manager of manufacturing

MACHINERY, December, 1960

## PUSH BUTTON *Speed Selection*

from to in seconds

or to *any* intermediate speed, instantly

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth

power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

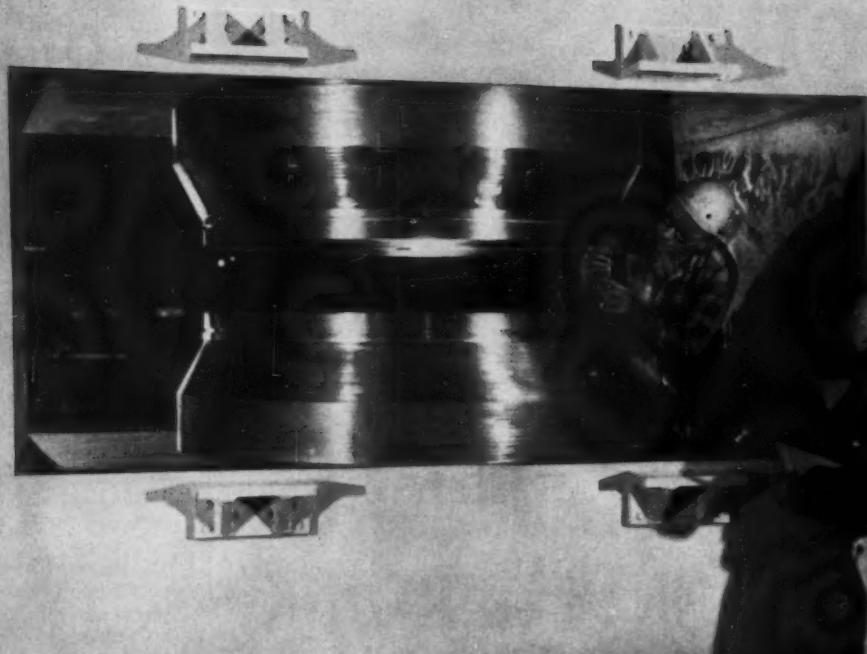
**SHELDON** *Variable Speed* PRECISION LATHES

Illustrated WMS6P 13" Swing- 34" Centers

**Write for**  
"Variable Speed" Circular and General Catalog showing . . .

- 10", 11", 13" and 15" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)
- 13" and 15" SEBASTIAN Geared Head Lathes
- SHELDON Milling Machines
- SHELDON Back Geared Shapers

**SHELDON MACHINE CO., INC.**  
4240 N. Knox Ave. • Chicago 41, ILL.



BETHLEHEM INSPECTORS measure the magnetic gap between the pole pieces of a magnet for the new University of Colorado cyclotron.

## 85-ton magnet for new research cyclotron forged, machined, and assembled by Bethlehem

The core of a new research cyclotron to be installed by the University of Colorado at Boulder is that 85-ton magnet you see above.

To make this magnet accurate and controllable, Bethlehem had to finish the huge magnet parts to thousandths and to micro-inch finishes. Most critical were the pole tips, which had to be machined to parallelism within 0.004 in. on the 52-in. diameter. They were machined a few thousandths oversize, then the final fitting and machining was done.

The forged pole pieces are tapered on the sides from 59 to 52 in. on the diameter, and are 14.4 in. thick.

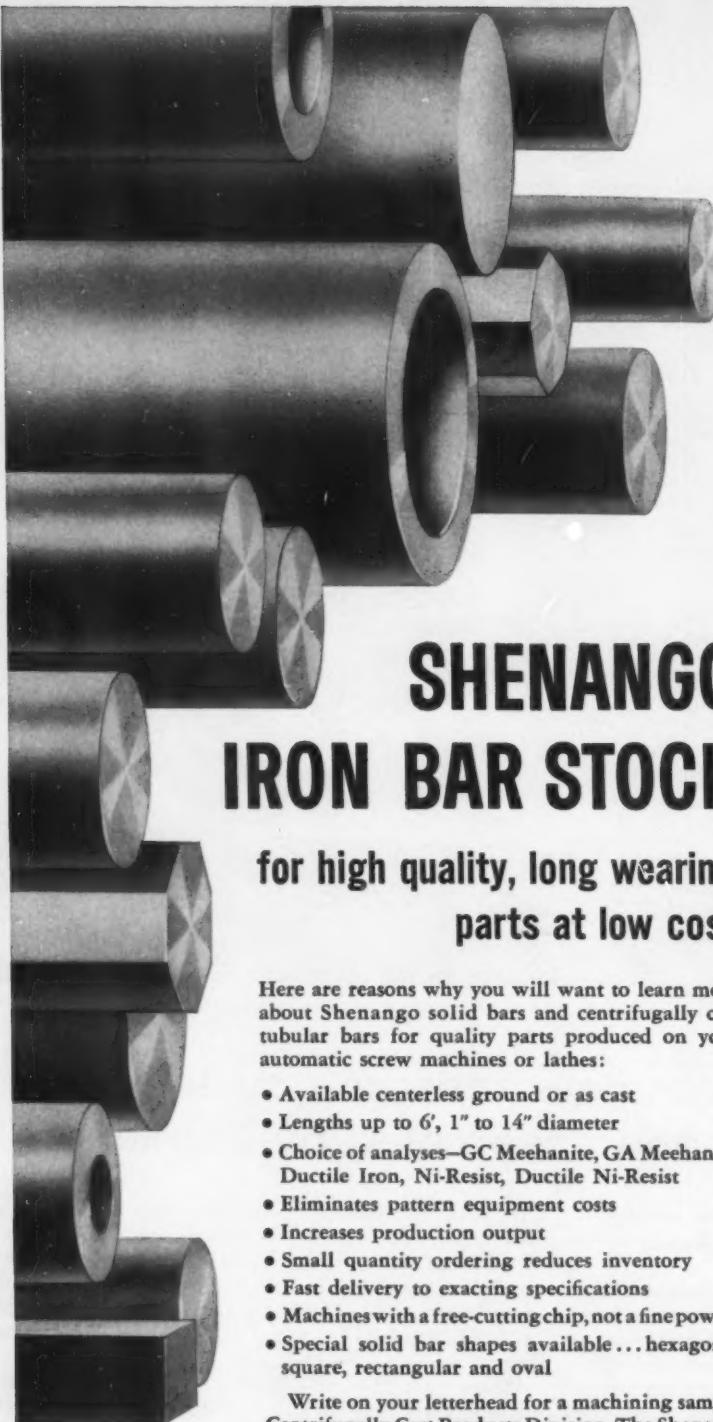
The yoke members, four of them, were forged in a 7500-ton hydraulic press, then machined to 250-micro-in. with mating surfaces finished to 125 micro-in. They weigh 73 tons, and are held together by large dowel pins and studs. They form a rectangular yoke assembly 142½ in. long, 60 in. wide, and 88½ in. high. The opening measures 96 by 42 in.

When completed, the Boulder cyclotron, a strong-focusing type, will have a capacity range of 10 to 30 million electron volts. The electrons will strike a target when their final speed is built up to  $\frac{1}{5}$  the speed of light.

Bethlehem Steel Company, Bethlehem, Pa. Export Sales: Bethlehem Steel Export Corporation

# BETHLEHEM STEEL





## SHENANGO IRON BAR STOCK

for high quality, long wearing  
parts at low cost

Here are reasons why you will want to learn more about Shenango solid bars and centrifugally cast tubular bars for quality parts produced on your automatic screw machines or lathes:

- Available centerless ground or as cast
- Lengths up to 6', 1" to 14" diameter
- Choice of analyses—GC Meehanite, GA Meehanite, Ductile Iron, Ni-Resist, Ductile Ni-Resist
- Eliminates pattern equipment costs
- Increases production output
- Small quantity ordering reduces inventory
- Fast delivery to exacting specifications
- Machines with a free-cutting chip, not a fine powder
- Special solid bar shapes available...hexagonal, square, rectangular and oval

Write on your letterhead for a machining sample.  
Centrifugally Cast Products Division, The Shenango  
Furnace Company, Dover, Ohio.

**SHENANGO** CENTRIFUGAL  
CASTINGS

COPPER, TIN, LEAD, ZINC BRONZES • MANGANESE AND ALUMINUM BRONZES  
MONEL METAL • NI-RESIST • MEEHANITE • METAL • ALLOY IRONS • DUCTILE IRON



Edward P. Sandbach, manager—  
manufacturing, Mackintosh-Hemp-  
hill Division of E. W. Bliss Co.

for the MACKINTOSH-HEMPHILL DIVISION of E. W. BLISS CO., Pittsburgh, Pa. Mr. Sandbach will be in charge of manufacturing operations at the division's Pittsburgh and Midland, Pa., plants.

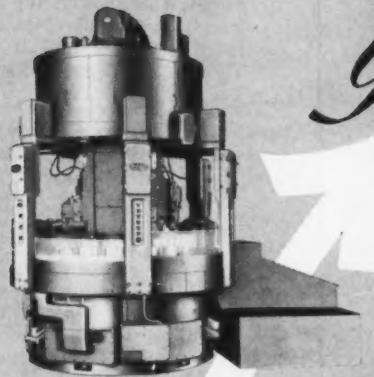
WILLIAM CRAWFORD has been made factory sales representative of WHITMAN & BARNES, a division of UNITED-GREENFIELD CORPORATION, Plymouth, Mich. Mr. Crawford will work with W&B distributors in servicing customers throughout the state of Florida.

## New Books

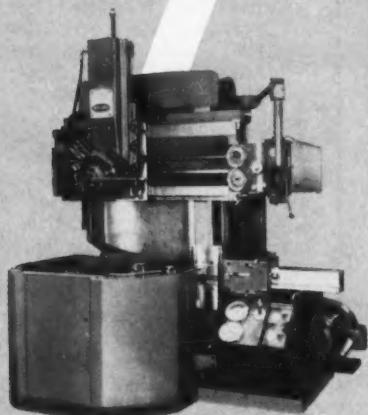
ENGINEERING MANUFACTURING METHODS. Second edition. By Gilbert S. Schaller. 682 pages; 6 by 9 inches; illustrated. Published by McGraw-Hill Book Co., Inc., 330 W. 42 St., New York 36, N. Y. Price, \$9.50.

This book is concerned with every phase of engineering manufacture. It gives a sound and complete treatment of fundamentals, emphasizing modern methods, equipment, and theories. An introductory chapter deals with the broader aspects of management administration as applied to manufacturing; a treatment of engineering materials gives special attention to the newer ones—aluminum, magnesium, cermets, plastics, etc. The use of Olivine and Zircon, CO<sub>2</sub> core and molding methods is emphasized. All of the new cold-shaping ideas are presented in detail. A chapter on hot shaping discusses the gigantic forging presses

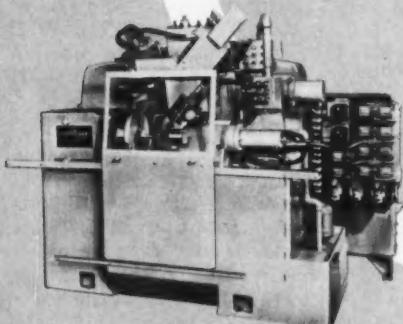
# to cut costs when cutting metal....



**Mult-Au-Matic, Type "L"**  
10" with 6, 8, 12, or 16 spindles, 14"  
and 18" with 6 or 8 spindles.



**Dynatrol V.T.L. and  
Vertical Boring & Turning Mill**  
26" to 86" in 10" increments and 108",  
124", and 144" table sizes.



**Man-Au-Trol V.T.L. and  
Vertical Boring & Turning Mill**  
For fully automatic operation, can be  
applied to any or all heads of Dynatrol  
at time of ordering or at a later date.

**Hydra-Feed Lathe**  
Automatic and tracer models each in  
four sizes.



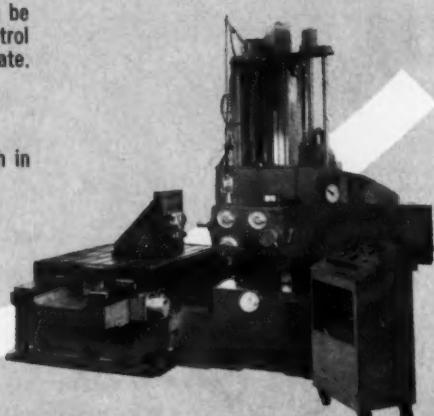
Day in and day out — in metalworking plants around the world — modern machine tools designed and built by The Bullard Company are proving their ability to produce more in less time — thus, reducing the cost per piece.

It will pay you to investigate and compare the many advantages offered by modern Bullard machine tools.

The Bullard Company Bridgeport 9, Connecticut

*Ask About Our Leasing Or Time Sales Plans*

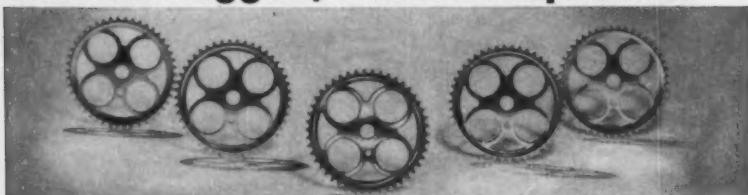
**Dynamill H.B.M.**  
In 3", 4" and 5" spindle size. Many  
combinations of bed length, table size  
and vertical travel.



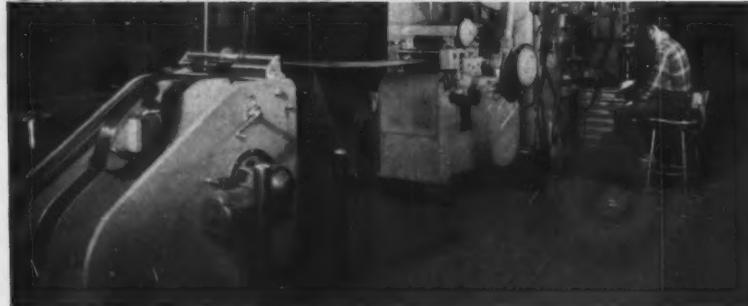
## The Schwinn Bicycle



### Gets Its Rugged, Precision Sprocket



### On This **LITTELL**-Fed Punch Press



Stamping out sprockets for famous Schwinn Bicycles is *precision stamping*. The special high strength steel stock is perfectly conditioned for accurate work. Flat stock, free of coil curvature, reaches the die area at perfectly timed intervals. For sprockets and other vital parts, Schwinn achieves this straightening-feeding precision economically, using the Littell "HRP" self-powered, hydraulically driven feeding and straightening machine. The "HRP" will serve you as well.

### "HRP" is Versatile, Accurate, Convenient



The straightening-feeding cycle of the self-powered HRP unit is synchronized with the stamping cycle of the press by a single electrical connection. HRP units remove the coil curvature, and feed the straightened stock to the press or shear at precisely the desired speed. They feed from either side of the press, or from front to back. They can be positioned at special angles to produce specially shaped parts. Pulling an electrical plug disconnects the "HRP" from the press. Furthermore, the "HRP" can be easily moved from press to press by a lift truck. Facts in Bulletin B-10.

#### 3 STANDARD "HRP" SIZES

##### STOCK CAPACITIES

12" wide x .090" thick  
18" wide x .062" thick  
24" wide x .050" thick

COILY Says:  
"Get Bulletin B-10.  
All facts. No charge."  
Write today to

4159 N. RAVENSWOOD AVENUE, CHICAGO 13



and the development of hot extrusion of steel. Also, the latest techniques in molding and automation are discussed, and the new ideas of vacuum melting and metal degassing are explained.

#### AMERICAN STANDARD PIPE THREADS

(EXCEPT DRYSEAL). ASA B2.1-1960. 42 pages; 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39 St., New York 18, N. Y. Price, \$3.

The standard includes specifications, dimensions, and gaging for taper and straight pipe threads, along with certain special applications. Revisions to the previously published standard include the internal diameter and the hand-tight engagement values for the 1/8- and 1/4-inch sizes. This has been done to correct for a disproportionate number of threads for hand-tight engagement. Seventeen pages of appendices are included.

#### AMERICAN STANDARD DRYSEAL PIPE

THREADS. ASA B2.2-1960. 49 pages; 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39 St., New York 18, N. Y. Price, \$3.50.

Previously the dryseal pipe threads were included in ASA B2.1, but now they are issued separately for the convenience of the user. Given are the specifications, dimensions, and gaging for taper and straight dryseal pipe threads. The internal diameter and the hand-tight engagement values for the 1/8- and 1/4-inch sizes have been revised from the previous standard to correct for a disproportionate number of threads for hand-tight engagement. Fourteen pages of appendices are included.

#### AMERICAN STANDARD REQUIREMENTS

FOR INSTRUMENT PRECISION  
BALL BEARINGS ASA B3.10-1960. 11 pages; 8 1/2 by 11 inches. Published by American Standards Association, Inc., 10 E. 40 St., New York 16, N. Y. Price, \$1.

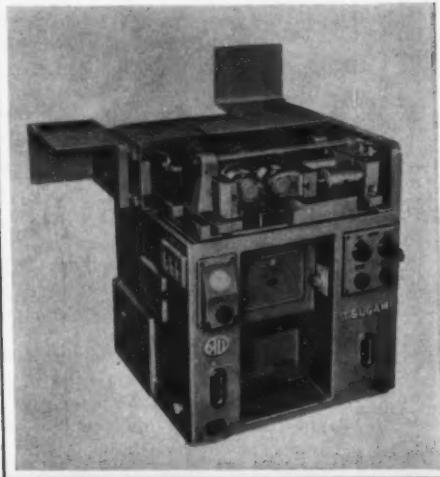
This standard establishes the characteristics which define an instrument precision ball bearing, boundary dimensions and tolerances, classifications used for selective assembly, internal clearances, and other requirements as they may be developed.

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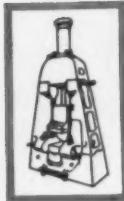
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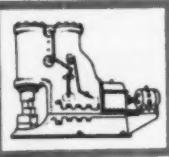


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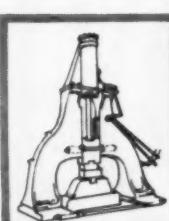
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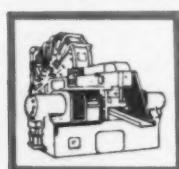
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cluded which give the dimensions in inches of the flanged and unflanged miniature range, the flanged and unflanged intermediate range, and the dimensions in millimeters of some unflanged intermediate range.

The standard is sponsored by the Anti-Friction Bearing Manufacturers Association.

AMERICAN STANDARD SPECIFICATIONS FOR THROW-AWAY CARBIDE INSERTS FOR CUTTING TOOLS ASA B80.1-1959. 50 pages; 8 1/2 by 11 inches. Published by American Standards Association, Inc., 10 E. 40 St., New York 16, N. Y. Price, \$4.50.

This standard covers dimensional specifications, styles, and designations of solid sintered-carbide inserts and their holders of the throw-away type. Three basic types of inserts and holders are listed: negative rake, positive rake, and neutral rake.

The negative-rake holders have three basic geometric shapes of insert: round, triangular, and square. The positive- and neutral-rake holders have two basic geometric shapes of insert: triangular and square.

The standard is well illustrated, and designations and dimensions are tabulated for easy reference. The sponsor of the standard is the Cemented Carbide Producers Association.

## Coming Events

MARCH 20-24—Twelfth Western Metal Exposition and Congress, sponsored by the American Society for Metals, to be held in Pan-Pacific Auditorium, Los Angeles, Calif. For more details, contact T. C. DuMond, ASM manager of Metal Congresses, American Society for Metals, Metals Park (Novelty), Ohio.

## Annual Index to MACHINERY

The annual index to Volume 66 of MACHINERY (September 1959 to August 1960, inclusive) is now ready for distribution. Readers who have not previously requested copies can obtain them without charge by writing to MACHINERY, Circulation Department, 93 Worth St., New York 13, N. Y.

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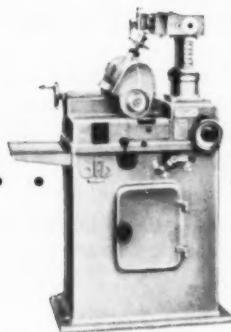
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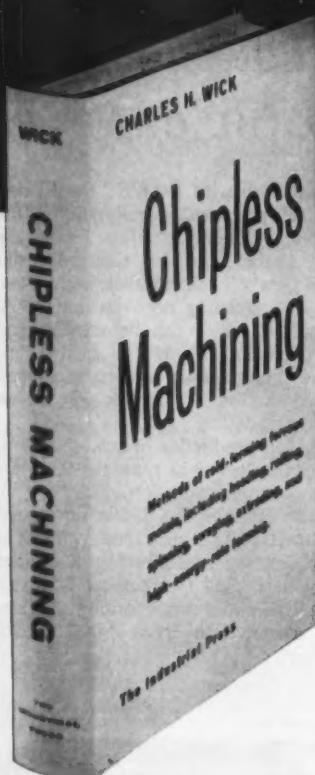
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259



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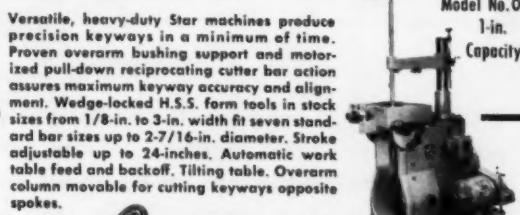
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DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

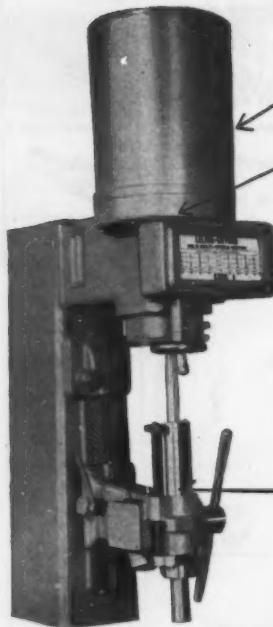
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For more data circle item 263B

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1. **TOTALLY ENCLOSED MOTOR**  
Windings and air gap completely protected from dust, dirt, chips.
2. **DIRECT DRIVE**  
Direct drive from four-speed motor to spindle for smooth power transmission. For extreme speed range, can be furnished with back gears. Speeds from 90 RPM up to 3600 with torque multiplication up to six times supplies brute power for large drills, ample speed for drills down to  $\frac{1}{16}$ ".
3. **INDICATING SHIFT**  
For positive speed indication. Tells right speed to use for drill sizes in three different SFM ranges. Convenient hand wheel shifts speed without stopping machine.
4. **OIL MIST LUBRICATION**  
Radial-thrust ball bearings are constantly and properly lubricated at all speeds by oil mist. Spindle splines lubricated by felt wipers.
5. **OVERSIZE SPINDLE QUILL**  
Oversize quills are  $2\frac{1}{8}$ " in diameter. Large bearing area maintains accuracy and assures long life.

## Only LELAND-GIFFORD Drilling Machines have all these Precision Features

### 6. INSERTED STEEL RACK

Inserted steel rack prevents radial motion which can cause uneven tooth loads on feed pinion. Also insures accurate alignment when multiple heads are used.

### 7. BROACHED SLOT

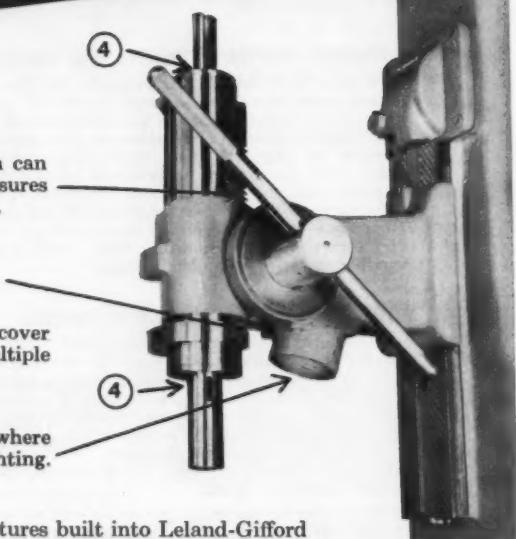
Rack slides in slot precision broached into head.

### 8. SPINDLE GUARDS

Telescopic guard can be furnished to completely cover the spindle, protect operator from fast-moving multiple splines.

### 9. BUILT-IN LIGHT

Built into sliding head. Puts the light on the work where it ought to be. Never in the way like makeshift lighting.



Compare the quality, workmanship and precision features built into Leland-Gifford Drilling Machines and you will see why they are the first choice of leading companies for toolroom and production lines.

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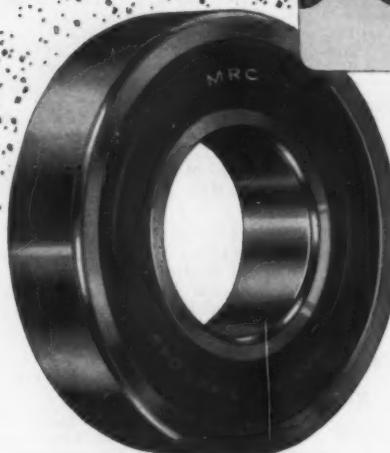
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This guide is compiled as a convenience to our readers. Every care is taken to keep it accurate.

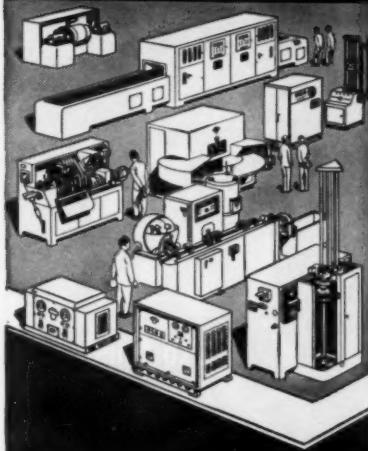
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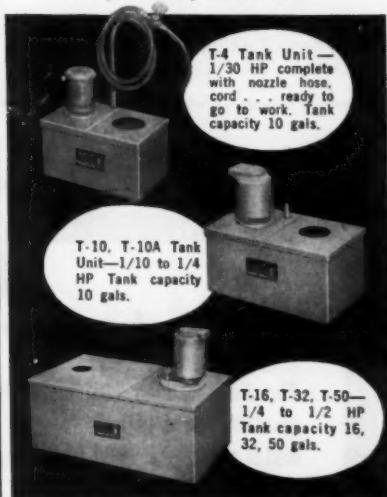
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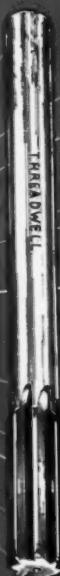
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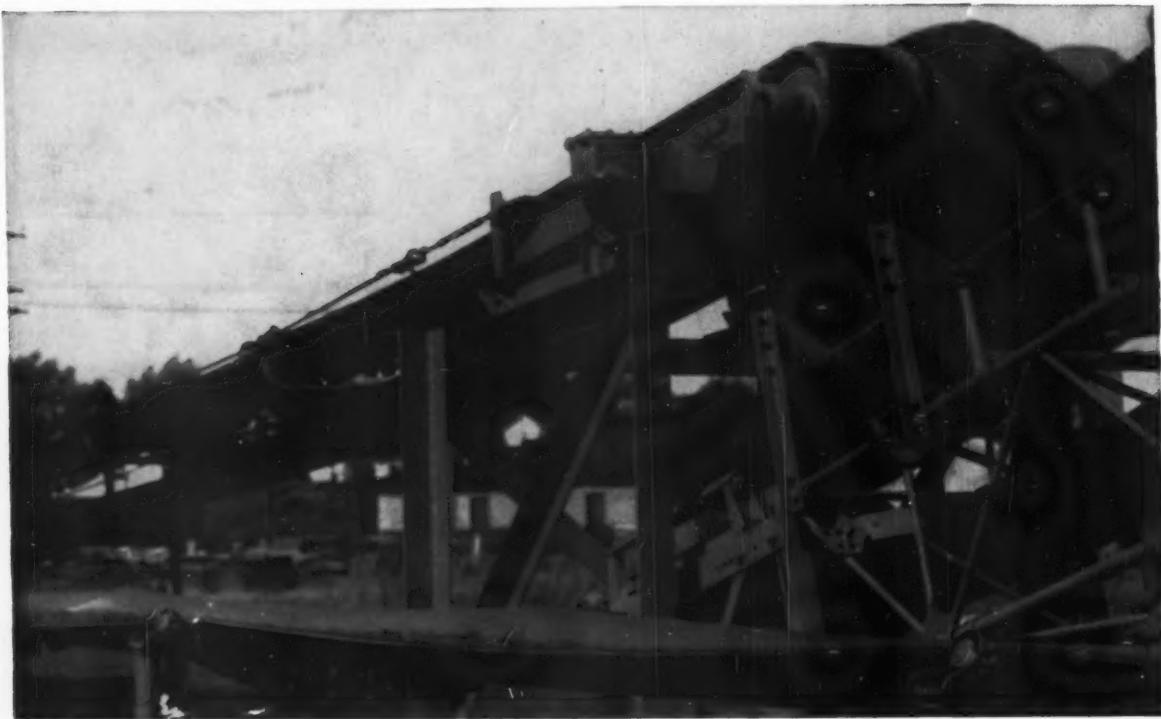
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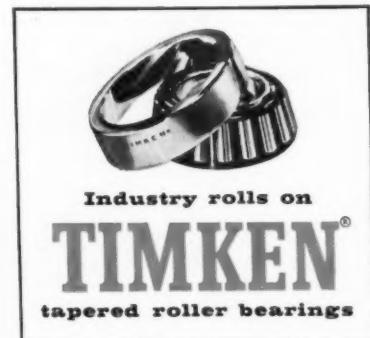
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